THE BRITISH JOURNAL

OF

OPHTHALMOLOGY

DECEMBER, 1930

COMMUNICATIONS

AN INVESTIGATION INTO THE EFFECT UPON THE EYES OF OCCUPATIONS INVOLVING CLOSE WORK

Being a résumé of work done for the Physiology of Vision Committee of the Medical Research Council

BY

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LONDON

THE investigations here described were undertaken in order to determine what effect (if any) upon the eyes is brought about by continuous close work, such as is necessitated in many branches of industry. It was thought probable that any deleterious effect would be most readily discovered in young adults in the second decade of life, since among those engaged upon such work the eyes, being still to some extent in the period of growth and development, are in the most labile state. We were, therefore, fortunate in being allowed access to the London School of Printing, and being given the opportunity of examining the apprentices working therein. The pupils here are youths, the majority of whom are between 14 and 20 years of age, and they may reasonably be taken as representative of the average physical standard. Since the institution is a day school, and the students work on the average between 9 a.m. and 6 p.m., going home at night, the conditions correspond closely to those of the average worker. The work which goes on in the school is of a very varied character, and includes such occupations as composing, where the opportunities of eye-strain are very considerable, as well as others such as training as warehousemen and binders, when the eyes are not used to any great degree. To a large extent, therefore,

controls were provided within the confines of the investigation itself. The pupils are of a relatively high standard of intelligence, so that their interest and co-operation were readily obtained for the purposes of the investigation, while the conditions of their apprenticeship made it possible for their individual cases to be continuously observed for periods of several years. The present report is based upon the examination of 244 apprentices: a considerably greater number of observations were taken, but only those are recorded in which four successive examinations were possible at nine months' intervals.

The questions which it was thought expedient to investigate were:

1. The visual acuity.
2. The refractive error (if any).
3. The power of accommodation.
4. The state of the muscle balance.
5. The presence and degree of binocular and stereoscopic vision.

The visual acuity was measured by Snellen's test types, placed at six metres distance in a darkened room, and illuminated locally by electric lights giving a relatively uniform illumination over the test card of three to four foot-candles.

The refraction was done by retinoscopy, a plane mirror being used. As a routine no mydriatic was employed, except in a few cases where accommodative disturbances were found to be present, when homatropine and cocaine drops were employed; in these cases the vision and the refraction are recorded as given in a post-mydriatic test.*

The power of accommodation was measured uniocularly and binocularly with the accommodation card of Duane.

The state of the muscle balance was estimated for distance by the Maddox rod test, the correction being made by prisms; for near vision the Maddox wing test was used.

Binocular and stereoscopic vision were investigated by the Worth amblyoscope.

The subjects examined may be divided as follows:—

Compositors	80
Machinists and Letter Press Printers ...	72
Binders and Warehousemen	44
Lithographers	10
Stereotypers	12
General students (doing everything) ...	26
Total	244

* The routine use of a mydriatic was found to interfere too much with the work of the school to be practicable.

Compositors

The compositors work in a large room provided with over-head windows, illuminated diffusely in the evening by over-head lights suspended from the ceiling. There is no local lighting provided. Each worker stands in front of a sloping bench which contains numerous small trays of type, each containing a large number of types of an individual letter. From out of these they pick letters and set them in a block by hand, thus building up lines of print. In this work a considerable amount of eye-strain may occur, as the types are frequently small, and after a certain amount of use are not easy to read. The types are made of an alloy of lead, antimony, and tin, which, when new, presents a bright metallic surface involving a considerable amount of glare. New types, however, form the minority of those used.

REFRACTION

The 80 compositors may be classified thus according to their refractions.

Emmetropic ...	12 subjects	15 per cent.
Myopic	34 subjects	42·5 per cent.
Hypermetropic	32 subjects	40 per cent.
Mixed	2 subjects	2·5 per cent.

1. *Emmetropes.* 12 subjects.

All the emmetropes remained so with the exception of two, in whom the refraction became slightly myopic. The highest myopic change in any meridian was −0·5 D.

2. *Myopes.* 34 subjects.

For purposes of classification these were divided into two categories:—

(*a*) Less than −1·0 dioptre of myopia in the most ametropic meridian.

(*b*) Greater than −1·0 dioptre of myopia in the most ametropic meridian.

(*a*) *Less than* −1·0 *D.* 22 subjects.

Of these

(*a*) There remained stationary 4 subjects.

(*b*) The myopia progressed in 18 subjects.

In no case did any diminution of the error take place.

In those cases wherein the myopia increased the amount of increase was small, averaging −0·5 D. The highest increase was less than −1·0 D.

(*b*) *Myopia greater than* −1·0 *D.* 12 subjects.

Of these

(*a*) There remained stationary 4 subjects.

(*b*) The myopia progressed in 8 subjects.

Again the advance of myopia was in each case relatively small, with the exception of two cases wherein an increase of −1·5 D. was registered within the period of three years. The average increase was 0·5 D.

3. *Hypermetropes.* 32 subjects.

Of these

(*a*) There remained stationary 22 subjects.

(*b*) The hypermetropia diminished in 10 subjects.

This finding is what one would expect in the ordinary course of events. The tendency is for hypermetropia to decrease in youth—if any change takes place—and the changes recorded were small, usually under 0·5 D., except in three cases.

4. *Mixed.* There were two cases of smaller errors both of which remained stationary. In both the error was −0·25 D. sphere +0·5 D. cylinder.

An analysis of these figures reveals the following facts:—

With regard to the initial state of the refraction the percentage of myopes is high (42·5 per cent.)

With regard to the progress of the refraction—

1. Emmetropes. 83·3 per cent. remained stationary.
   16·7 per cent. became myopic: in these the change was small.

2. Myopes. (*a*) Small errors.

   18·2 per cent. remained stationary.
   81·8 per cent. progressed by an average of −0·5 D.

   (*b*) Large errors.

   33·3 per cent. remained stationary.
   66·6 per cent. progressed by an average of −0·5 D.
   In 16·6 per cent. the increase was rapid (−0·75 to −1·5 D).

3. Hypermetropes.

   69 per cent. remained stationary.
   31 per cent. became less hypermetropic.
   In 12·5 per cent. the decrease was rapid.

These results of a record of three years' change show a change in direction towards myopia more than would be expected.

MUSCLE BALANCE.—An examination of the muscle balance showed that 52 of the 80 subjects (65 per cent.) had heterophoria of more than 1° prism.

1. The most common error was esophoria (85 per cent.), the average error for distance being 3° prism, and for near vision being 6° prism.

Hyperphoria occurred in 10 per cent., the error being small and averaging 1·5° prism.

Exophoria occurred in 5 per cent., the error being small and averaging 2° prism.

Repeated examinations of the muscle balance showed no definite trend for the better or for the worse, and, while the error in the majority of cases remained to all intents and purposes stationary throughout in the majority of cases, in others it altered in a very variable degree. Moreover, it changed in degree from day to day and at different times during the same day: thus, on the whole, heterophoria was less evident on Monday than on Friday, and the same individual would show a considerably greater degree of imbalance at 6 p.m., than was elicited at 10 a.m. One would expect it to vary in this way directly with the degree of muscular fatigue. The measurements are, therefore, not given in detail, and they should be accepted only as a rough approximation of a quantity too variable to estimate accurately.

The muscle balance reveals a very high percentage of esophoria, which was practically invariably of the type which is due to convergence excess. While a certain amount of this may be an advantage for near work, the degree of the error appears to be too pronounced to be passed over unnoticed. It is noticeable that it occurred almost as much among the myopes as among the hypermetropes, although it was not so marked in the former.

The visual acuity with the proportionate correction almost invariably came up to 6/6, and investigation of the power of accommodation and the degree of binocular and stereoscopic vision led to no results of interest.

Machinists and Letterpress Printers

The work conducted by this class is varied; most of it involves no great eye-strain. To a large extent it consists of watching mechanical machinery. In colour reproductions, however, fine work is entailed where the coloured lines in illustrations have to be superimposed with an accuracy amounting in some cases to 1/1000 inch. The cutting out of half-tone blocks also involves a considerable amount of near work. The room wherein this work is done is lit by overhead windows, supplemented by side windows, and at night by diffuse light from the ceiling.

REFRACTION

The 72 subjects of this class may be classified thus according to their refraction :—

Emmetropic	...	nil.	
Myopic ...	...	22 subjects	30·5 per cent.
Hypermetropic	...	50 subjects	69·5 per cent.

1. *Myopes.*

(*a*) Less than −1·0 D. in the most ametropic meridian: 14 subjects.

Of these

(*a*) There remained stationary 8 subjects.

(*b*) The myopia progressed in 6 subjects.
In no case did the increase in myopia exceed −0·5 D.

(*b*) A myopia greater than −1·0 D.: 8 subjects.

Of these

(*a*) There remained stationary—4 subjects.

(*b*) It progressed in 4 subjects.

The highest progression was of −1·5 D.; the average progression was −0·5 D.

2. *Hypermetropes.* 50 subjects.

Of these

(*a*) There remained stationary—35 subjects.

(*b*) The hypermetropia diminished in 15 subjects.
In all of these the diminution was small and was well within physiological limits (about −0·5 D.), and could be taken to correspond to the degree of change which one could reasonably anticipate in a group of normal subjects of this age.

An analysis of these figures reveals the following facts :—

1. Emmetropes. Nil.
2. Myopes. (*a*) Small errors.
57·1 per cent. remained stationary.
42·9 per cent. progressed with an average of −0·5 D.

(*b*) Large errors.
50 per cent. remained stationary.
50 per cent. progressed with an average of −0·5 D.

3. Hypermetropes. 70 per cent. remained stationary.
30 per cent. became slightly less hypermetropic.

The HETEROPHORIA shown by this group of subjects was as follows:—

The error was limited almost entirely to esophoria—45 subjects (64·3 per cent.) It was small, averaging 2° prism for distance vision, and a 4° prism for near vision. The type of esophoria again was of the nature of excess of convergence.

Exophoria was found in four subjects: the average error was 2° prism.

Hyperphoria was found in three subjects: the average error was 2° prism.

Warehousemen and Binders

The warehousemen and binders work as a general rule in a large room with benches alongside the walls, which are well provided with side windows. The work is varied and does not involve any particular eye-strain; the sewing and glueing of books, the making and fitting of bindings, etc.

REFRACTION

The 44 subjects of this class may be classified thus according to their refraction:—

Emmetropic ...	2 subjects	4·5 per cent.
Myopic	12 subjects	27·3 per cent.
Hypermetropic ...	26 subjects	59·1 per cent.
Mixed	4 subjects	9·1 per cent.

1. *Emmetropes.* The refraction of the two emmetropes remained stationary.

2. *Myopes.* The 12 myopes all had a refractive error less than −1·0 D.

66·6 per cent. remained stationary.

33·3 per cent. progressed by an average of −0·25 D., and the greatest deterioration was −0·5 D.

3. *Hypermetropes.* Of the 26 hypermetropes only three (11·5 per cent.) got slightly less hypermetropic; in no case was the diminution more than −0·25 D.

4. *Mixed Cases.* Of the four mixed cases, three (75 per cent.) remained stationary and one became more myopic.

MUSCLE BALANCE.—An investigation of the muscle balance revealed comparatively slight abnormalities, six of them (13·6 per cent.) having a small degree of esophoria averaging 2° prism.

Lithographers

Lithography involves no great degree of eye-strain. The copying and making of impressions on a stone or zinc plate is done in a well-lighted room with side-windows. Ten subjects of this class were under examination.

REFRACTION

These may be classified thus according to their refraction:—

Emmetropic	1 subject.
Hypermetropic	6 subjects.
Myopic	3 subjects.

1. *Emmetropes.* The emmetrope remained stationary throughout the period of observation.

2. *Myopes.* Of the three myopes one remained stationary, and two progressed, one by −0·5 D. and the other by −1·0 D. in the meridian of greatest refraction.

3. *Hypermetropes.* In the six hypermetropes the refraction remained stationary in five, while one subject got more hypermetropic; in this last the error changed from +1·25 to +1·75 D. sphere.

MUSCLE BALANCE.—An examination of the muscle balance revealed the fact that two subjects (20 per cent.) had a small degree of esophoria (averaging 3° prism) and that one subject (8·3 per cent.) had a small degree of hypophoria averaging 2° prism.

Stereotypers

The work of stereotypers is varied and is carried on in a dark basement illuminated by diffuse and local light. In some of the types of work there is a considerable amount of glare from the bright surface of metal. Only 12 subjects of this class were available for examination.

REFRACTION

The examination of refraction of these showed

Emmetropic	nil.
Myopic	6 subjects.
Hypermetropic	6 subjects.

1. *Myopes.* There remained stationary two subjects (33·3 per cent.) The myopia progressed in four subjects (66·6 per cent.) In each case progression was small, less than −0·5 D.

2. *Hypermetropes.* Of the six subjects—

(*a*) There remained stationary four subjects.

(*b*) A slight myopia developed in one involving a decrease of hypermetropia of +0·37 D.

(*c*) A slight increase in hypermetropia occurred in one, the increase being 0·25 D.

MUSCLE BALANCE.—An examination of the muscle balance of these subjects showed that four (33·3 per cent.) had a slight degree of esophoria.

Students engaged in all Occupations

There is a considerable number of students who go through the entire curriculum of studies at the Printing School: 26 of these were kept under examination.

REFRACTION

These may be divided into the following classes according to their refraction—

Emmetropic	nil.
Myopic	8 subjects.
Hypermetropic	17 subjects.
Mixed	1 subject.

1. *Myopes.* Of the eight subjects—

(*a*) Five remained stationary.

(*b*) Three progressed. They all had an error less than −1·0 D. sphere, except one, but the amount of progression in each case was less than −0·5 D.

2. *Hypermetropes.* Of the 17 subjects, two only showed a change in the direction of myopia amounting to −0·5 D.

3. *Mixed.* The subject with mixed astigmatism remained stationary.

MUSCLE BALANCE.—Of the 26 cases, four subjects (15·3 per cent.) showed a heterophoria. Of these three (11·5 per cent.) had esophoria due to excess of convergence of 2°, 3°, and 7° prism respectively, and one had a hyperphoria of 3° prism.

Summary

A résumé in statistical form of these results is appended: the first figures in each column give the percentage of cases, and the figures in brackets give the actual numbers.

Number of Subjects	Compositors	Machinists	Warehousemen	Lithographers	Stereotypers	General
	80	72	44	10	12	26
Initial Refraction						
1. Emmetropes	15 (12)	Nil	4·5 (2)	10 (1)	Nil	Nil
2. Myopes	42·5 (34)	30·5 (22)	27 (12)	30 (3)	50 (6)	31 (8)
3. Hypermetropes	40 (32)	69·5 (50)	59·5 (26)	60 (6)	50 (6)	65 (17)
4. Mixed	2·5 (2)	Nil	9 (4)	Nil	Nil	4 (1)
Heterophoria	65 (52)	69·5 (50)	13·5 (6)	20 (2)	33 (4)	11·5 (3)
Change of Refraction						
I. Emmetropes:—						
(*a*) Stationary	83 (8)		100 (2)	100 (1)	Nil	Nil
(*b*) Became myopic	16 (2)	Nil	Nil	Nil		
(*c*) Became hypermetropic	Nil		Nil	Nil		
II. *Myopes Total*						
(*a*) Stationary	23 (8)	54·5 (12)	67 (8)	33 (1)	33 (2)	62·5 (5)
(*b*) Progressed	77 (26)	45·5 (10)	33 (4)	67 (2)	67 (4)	37·5 (3)
**Small Errors*						
(*a*) Stationary	18 (4)	57 (8)	67 (8)	33 (1)	33 (2)	72 (5)
(*b*) Progressed	82 (18)	43 (6)	33 (4)	67 (2)	67 (4)	28 (2)
(i) Increase small*	82 (18)	43 (6)	33 (4)	67 (2)	67 (4)	28 (2)
(ii) Increase large*	Nil	Nil	Nil	Nil	Nil	Nil
(*c*) Diminished	Nil	Nil	Nil	Nil	Nil	Nil
**Large Errors*						
(*a*) Stationary	33 (4)	50 (4)				Nil
(*b*) Progressed	67 (8)	50 (4)				100 (1)
(i) Increase small*	50 (6)	37·5 (3)	Nil	Nil	Nil	100 (1)
(ii) Increase large*	17 (2)	12·5 (1)				Nil
(*c*) Decrease	Nil	Nil				Nil
III. *Hypermetropes*						
(*a*) Stationary	69 (22)	70 (35)	88·5 (23)	83·5 (5)	67 (4)	88 (15)
(*b*) Progressed	Nil	Nil	Nil	16·5 (1)	16·5 (1)	Nil
(*c*) Diminished	31 (10)	30 (15)	11·5 (3)	Nil	16·5 (1)	12 (2)
(i) Diminution small	28 (9)	30 (15)	11·5 (3)	Nil	16·5 (1)	12 (2)
(ii) Diminution large	3 (1)	Nil	Nil	Nil	Nil	Nil
IV. *Mixed*						
(*a*) Stationary	100 (2)		75 (3)			100 (1)
(*b*) Became myopic	Nil	Nil	25 (1)	Nil	Nil	Nil
(*c*) Became hypermetropic	Nil		Nil			Nil

**Small* in each case represents less than 1·0 dioptre in the meridian of greatest ametropia;
Large an error greater than 1·0 dioptre.

On the whole it may be taken as a general rule that the compositors are engaged on the work which entails the greatest strain on the eyes. In the majority of the other branches of the work of the school not only is less near work involved, but it is almost invariably of a more varied character. It may therefore be interesting to compare the subjects in two classes—compositors and other occupations.

NUMBER.	Compositors	Others
	80	164
Initial Refraction		
1. Emmetropes	15 (12)	2 (3)
2. Myopes	42·5 (34)	31 (51)
3. Hypermetropes	40 (32)	64 (105)
4. Mixed	2·5 (2)	3 (5)
Heterophoria	65 (52)	39·5 (65)
Change of Refraction		
I. *Emmetropes*		
(*a*) Stationary	83·3 (8)	100 (3)
(*b*) Became myopic	16·7 (2)	Nil
II. *Myopes*		
(*a*) Stationary	23 (8)	55 (28)
(*b*) Progressed	77 (26)	45 (23)
(i) Small errors:		
(*a*) Stationary	18·2 (4)	5·7 (24)
(*b*) Progressed to small degree	81·8 (18)	43 (18)
(*c*) Progressed to large degree	Nil	Nil
(ii) Large errors:		
(*a*) Stationary	33·3 (4)	44·5 (4)
(*b*) Progressed	66·7 (8)	55·5 (5)
(i) To small degree	50 (6)	44·5 (4)
(ii) To large degree	16·7 (2)	11 (1)
III. *Hypermetropia*		
(*a*) Stationary	69 (22)	78 (82)
(*b*) Became myopic	31 (10)	20 (21)
(i) To small degree	28 (9)	20 (21)
(ii) To large degree	3 (1)	Nil
(*c*) Became more hypermetropic	Nil	2 (2)
IV. *Mixed*		
(*a*) Stationary	100 (2)	80 (4)
(*b*) Became myopic	Nil	20 (1)

Conclusions

Reviewing these figures it is obvious that the compositors do not bear comparison well with those engaged in other occupations.

Not only do their numbers contain initially a considerably higher percentage of myopes, but the number in which the refractive error increases towards myopia is also higher. Moreover, the percentage suffering from a considerable amount of muscular imbalance is higher.

These figures suggest that the occupation which entails the greatest degree of eye-strain has the most deleterious effect upon vision; and that one of the results of such an occupation is to encourage the development of short-sightedness. It is to be noted that some of the members of this class do complain of inadequacy of the illumination in the room, especially when working with artificial light.

It is to be remembered, of course, that the age period over which observations were taken represents a relatively labile phase in the refraction of the eye: and it is not to be expected that the same degree of progression will be evident later in life.

THE DRAINAGE OF THE INTRA-OCULAR FLUIDS

BY

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IT will be recalled that a paper was read by F. Ridley in the session of the Ophthalmological Society of the current year on the mechanism of the drainage of the intra-ocular fluids; appearing now in print (*Brit. Jl. of Experimental Pathology*, Vol. XI, p. 217, abstracted on p. 633) its contents can be adequately followed. The arguments which are brought forward in the attempt to re-establish an old hypothesis that the greater part of the drainage of the aqueous humour occurs not through the canal of Schlemm but through the cornea into the conjunctival sac, merit some comment, even at the cost of some repetition of what has been already published.

Ridley, after considering the anatomical relations at the canal of Schlemm in the light of the work of T. Henderson (1908) and Arthur Thomson (1911) [most of the questions raised are adequately answered in the classical work of Maggiore, 1917] concludes that " since minute particles such as those of Indian ink do not pass into the lumen of the canal from the anterior chamber (Nuel and Benoit, 1895), there is evidence that no such direct communication

between the anterior chamber and the canal exists." Many other authors (Duke-Elder, 1927, p. 83) have shown the same thing, but the failure of particulate matter to pass through the endothelial cells of Schlemm's canal has no possible relation to the passage of fluid. Ridley has failed to show that particulate matter is delivered out of the eye through the cornea: this argument, therefore, denies his main thesis.

The theory of the drainage of the aqueous humour through the cornea is based upon experiments which show:

(1) That the cornea of the dead eye acts as a permeable membrane under the influence of the osmotic pull of a solution of cane sugar: this applies to almost every tissue.

(2) That substances can diffuse from the conjunctival sac into the anterior chamber: this has been accepted since the work of de Ruiter (1853), v. Graefe (1854), and others.

(3) That substances introduced into the anterior chamber diffuse through the cornea entering at the site of the filtration angle: this has been generally accepted since the work of Laqueur (1872), Gruber (1894) and Leber (1889—1903). It is to be remembered, however, as was observed by Parsons in discussing the same hypothesis in 1904, that the phenomena of the diffusion of foreign substance need bear no relation to the normal flow of fluid.

(4) That the rate of drainage through the cornea equals the rate of formation of the intra-ocular fluid. The first of these measurements was obtained by measuring the rate of flow under a pressure head of 20 cm. water through a dead cornea, a measurement which must have merely a hypothetical relation with the conditions in life. The second is taken from Friedenwald (1930), quoted as unpublished experiments " wherein the time required for the evacuation of the aqueous could be measured." Such experiments have been done since the time of Hovius (1702). On this point my remarks (p. 85 *et seq.* 1927) still hold good: the conditions of experimentation on the evacuation of the aqueous humour are completely artificial and, involving a complete dislocation of the pressure equilibrium in the eye, can bear no relation to the normal conditions.

Against these experiments I would put forward one only, which to my mind is conclusive. A needle connected to a reservoir is inserted into the anterior chamber of an anaesthetized dog. The system is filled with methylene blue and the pressure equilibrated by means of an air-bubble. The reservoir is raised giving a pressure-head of 1 to 2 mm. Hg: coloured fluid slowly flows into

the anterior chamber: in one and a half minutes the episcleral veins are deeply dyed: there is no evidence of any colouration of the cornea nor the minutest evidence of dye in the conjunctival sac. Admittedly the circulation here is an artificially induced pressure circulation, but the available channels of exit are obviously *via* Schlemm's canal and the episcleral veins and not by way of the cornea.

With regard to the mechanism of the intra-ocular pressure, Ridley shows that the sclera is distensible and thereby corroborates the work of Weber (1876), Ischreyt (1899), Koster (1895—1900—1901) on pig, rabbit, and human eyes, but his conclusion that changes in the intra-ocular pressure are determined by changes in the vascular bed of the uveal tract to the exclusion of changes in volume of the ocular media does not conform to facts. No one denies that changes in the circulation influence the intra-ocular pressure profoundly, but I have shown (1926—29) that hypotension can occur with maximal vaso-dilatation. He denies a swelling of the vitreous [without producing any evidence to refute its proved occurrence (Duke-Elder, 1929)], and considers that the clinical appearance of an eye in glaucoma is due to a turgescence of the uveal vessels pushing the vitreous forward. Admittedly such a mechanism may exist—but not exclusively. Commenting on a similar suggestion put forward by Magitot (1917), I wrote (1927) that section of an eye with chronically raised tension frequently shows a thin and atrophied choroid, ciliary body, and iris, the whole uveal tract being obviously pressed almost out of existence by something else (the vitreous).

Finally the conclusion is reached that the conditions of experimentation employed by me (1927) are unsatisfactory because in my chemical analysis pooled samples of aqueous humour and serum were employed. He appears, however, to have failed to note that this rough estimation, of which it was stated " that it cannot lay claim to quantitative accuracy " (1927, p. 13) was followed by micro-analyses of the principal constituents of each class of substance of which accurate chemical estimation in quantities so minute is possible, and that these showed the same relationship. In these cases the estimation in the aqueous humour was compared with the corresponding concentration in the arterial and the venous plasma of the same animal taken at the same time. He appears also to have failed to observe that my measurements of the osmotic pressure were taken under the same conditions. In conclusion, the argument that the theory of Donnan, being strictly applicable to infinitely dilute solutions, cannot be applied to biological problems challenges so intimately an enormous amount of work done by physiologists and biochemists for the last two decades that its answer can be left in their hands. No biological problem

will be found to conform with precise mathematical accuracy to any law: all the conclusions of biology are approximations.

REFERENCES

Duke-Elder, W. S. (1926).—*Brit. Jl. of Ophthal.*, Vol. X, p. 1.
——— (1927).—*The Nature of the Intra-ocular Fluids.* London.
——— (1927).—*Jl. of Physiol.*, Vol. LXII, p. 315.
——— (1927).—*Biochem. Jl.*, Vol. XXI, p. 66.
——— (1929).—*Brit. Jl. of Ophthal.*, Vol. XIII, p. 385.
——— (1929).—*Trans. Ophthal. Soc. U.K.*, Vol. XLIX, p. 81.
Friedenwald, J. S. (1930).—*Pathology of the Eye.*" London.
v. Graefe (1854).—*Arch. f. Ophthal.*, Bd. I, H. 1.
Gruber (1894).—*Arch. f. Ophthal.*, Bd. XL, H. 4.
Henderson, T. (1908).—*The Ophthalmoscope*, Vol. VI, p. 746.
Hovius (1702).—*De circulari humorum motu in oculo.* Traj. ad. Rhen.
Ischreyt (1899).—*Arch. f. Ophthal.*, Bd. XLVIII, H. 2 and 3.
Koster (1895).—*Arch. f. Ophthal.*, Bd. XLI, H. 2.
——— (1900).—*Ibid.*, Bd. XLIX, H. 2 and 3.
——— (1903).—*Ibid.*, Bd. LII, H. 3.
Laqueur (1872).—*Zentralb. med. Wiss.*, Bd. X, S. 577.
Leber, T. H. (1899).—*Arch. f. Ophthal.*, Bd. XXXV, H. 1.
——— (1903).—*Graefe-Saemisch Handb.*, II Aufl., Bd. I, Teil 2.
Maggiore (1917).—*Struttura, comportamento e significato del Canale di Schlemm nell' occhio umano.* Rome.
Magitot, A. (1917).—*Ann. d'Ocul.*, T. CLIV, pp. 272, 334, 385.
Nuel and Benoit (1895).—*Arch. f. Ophthal.*, Bd. XLI.
Parsons, J. H. (1904).—*Pathology of the Eye.* London.
de Ruiter (1853).—*Inaug. Dissertation.* Traj. ad. Rhen.
Thomson, A. (1911).—*The Ophthalmoscope*, Vol. IX, p. 470.
Weber (1876).—*Arch. f. Ophthal.*, Bd. XXIII, H. 1.

TORIC SPECTACLES

BY

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THE outer rim of an inflated motor tyre tube presents a toric surface; on transverse section a small circle would be seen, but on longitudinal section the outer rim would be represented by a much larger circle of much less curvature. A small area of this tube would present the toric form of a convex spherocylinder where its two principal powers are worked on the same surface with their axes at right angles to one another. A convex toric very roughly resembles the side of an egg seen from the outside, and a concave toric the side of an egg seen from the inside, but an egg is only circular in transverse section.

Toric tools are made to bases of $\pm$3·0 D., $\pm$ 6·0 D. and $\pm$ 9·0 D., the base $\pm$6·0 D. being the commonest, although for exact periscopic work many others are needed. The base (B) is always the lower power of the cylinder required, in this paper the higher power will be represented by B′.

A toric lens should be prescribed in the form of crossed cylinders, or if not, the toric base should always be specified.

For instance a spherocylinder +3·0 D. sph. +2·0 D. cyl. ax. 90°, if prescribed as a toric on a +3·0 D. base, is written +3·0 D. cyl. ax. 180° +5·0 D. cyl. ax. 90°.

To express any spherocylinder as a toric lens combination.

Write the spherocylinder in the form of crossed cylinders.
Three cases may arise:—

I. Crossed cylinders of the same sign.
Let C_1 denote the lower, C_2 the higher cylinder.
(1) Base B of the same sign as that of the crossed cylinders.
Let $C_1 - B = S$ where S is the new spherical surface
$\therefore C_1 - S = B$ and $C_2 - S = B'$.
(2) Base B of opposite sign to that of the crossed cylinders.
Let $C_2 - B = S$
$\therefore C_2 - S = B$ and $C_1 - S = B'$.

II. Crossed cylinders of opposite sign.
Let C be that cylinder whose sign is opposite to that of B, then $C - B = S$.

Examples I. (1) +2·5 D. sph. +1·5 D. cyl. ax. 80°
written as crossed cyls. +2·5 D. cyl. ax. 170° +4·0 D. cyl. ax. 80°.
Suppose the base +3·0 D. be chosen, then
2·5 D. − 3·0 D. = S = − 0·5 D. sph.
$C_1 - S = B$ or 2·5 + 0·5 = +3·0 D.
$C_2 - S = B'$ or 4 + 0·5 = + 4·5 D.
and the prescription is +3·0 D. cyl. ax. 170° + 4·5 D. cyl. ax. 80°
− 0·5 D.

This means that the toric surface is to be placed anteriorly and the concave surface is to be placed next the eye.

I. (2) Suppose that we wish to prescribe the same spherocylinder in toric form on a − 6·0 D. base.
4 D. + 6 D. = S = +10·0 D. sph.
$C_2 - S = 4 - 10 = -6{\cdot}0$ D.; $C_1 - S = 2{\cdot}5 - 10 = -7{\cdot}5$ D.
so the prescription is +10·0 D.
− 6·0 D. cyl. ax. 80° − 7·5 D. cyl. ax. 170°

II. Spherocylinder − 1·0 D. sph. + 3·0 D. cyl. ax. 100°
Crossed cyls. − 1·0 D. cyl. ax. 10° + 2·0 D. cyl. ax. 100°
Let base be +6·0 D.
− 1·0 D. − 6·0 D. = S = − 7.0 D. sph.
− 1·0 D. +7·0 D. = +6·0 D.; + 2·0 D. +7·0 D. = +9·0 D.
+6·0 D. cyl. ax. 10° + 9·0 D. cyl. ax. 100°
− 7·0 D.
is the prescription for the toric combination.

A patient of mine once showed me a prescription that was given to her by another specialist in the form +2·5 D. sph. +1·5 D. cyl. ax. 80° with the note at the bottom " give torics." It is our

duty to order those torics that will be of real service if we order them at all. In the example given in I (1) there would be little advantage over the ordinary spherocylinder provided that the cylindrical surface were ordered to be next the eye.

It is clear on referring to the table at the end of this paper that in the meridian at 80°, where the power is +2·5 D., the ocular concavity should be −6·5 D.; while in the meridian at 170°, where the power is + 4·0 D., the ocular concavity should be −6·75 D.

Again in the second example, although it is better than the first, where the power is 2·5 D. the concavity is −6·0 D., and where the power is +4·0 D. the concavity is −7·5 D.

There are six different ways in which the optician could have obeyed the orders of the ophthalmic surgeon in giving toric lenses to this patient, but only one of them would give really satisfactory results with the tools in use—namely that on a +9·0 D. base. It is our business, if we order toric lenses, to state what kind of toric lenses we wish; just as much as it is a physician's business to give the quantities of the medicines he prescribes.

The best prescription for this spherocylinder that will give the greatest range of vision, when the eyes are rotated behind it, is

$$\frac{+9{\cdot}0 \text{ D. cyl. ax.} 170^\circ + 10{\cdot}5 \text{ D. cyl. ax. } 80^\circ}{-6{\cdot}5 \text{ D. sph.}}$$

The last example for −1·0 D. sph. + 3·0 D. cyl. ax. 100° is not very good, but it is the best that can be obtained with the ordinary tools. The concavity given is −7·0 D., it should be −7·25 D. in one meridian and −6·5 D. in the other meridian. Theoretically, the best prescription for periscopic purposes would be

$$\frac{+6{\cdot}25 \text{ D. cyl. ax. } 10^\circ + 8{\cdot}5 \text{ D. cyl. ax. } 100^\circ}{-6{\cdot}5 \text{ D. cyl. ax. } 100^\circ - 7{\cdot}25 \text{ D. cyl. ax. } 10^\circ}$$

but tools are not made for either of these torics. Practically nearly all patients would be quite satisfied with the ordinary spherocylinder if the −1·0 D. sph. were placed next the eye.

In conclusion we may say that for low powers of concave spherocylinders toric lenses are almost unnecessary, provided that the concave spherical surface is placed next the eye. Frequently a transposition of the cylinders may be advisable, if that will render the ocular surface more nearly that recommended in the table.

For instance, −3·5 D. sph. −3·0 D. cyl. ax. 180° if transposed to −6·5 D. sph. +3·0 D. cyl. ax. 90° would be an almost perfect periscopic reading glass, and would allow a very wide field for distance. It is true that the glasses would be slightly heavier than those in the ordinary form, but the periscopic advantage would more than compensate for that objection.

It will be noticed that in the case of concave spherocylinders a different ocular curvature is recommended for each power in the two meridians of the crossed cylinders, so that in most cases two torics made by special tools for each lens would be required, which would render the price prohibitive.

Whenever high convex glasses are required there is a much more urgent call for periscopic glasses than in cases of myopia, for the field of view on oblique vision through biconvex lenses is much more restricted than through biconcave lenses. However, fortunately the ocular concavity varies for distant vision only between −6·5 D. and −7·0 D. between the powers of 1·0 D. and +12·5 D., so it would appear that all convex spherocylinders for distance should be ordered with the ocular surface having a concavity of −6·5 D. to −7·0 D. sph. But as +9·0 D. base is the highest toric made, we are restricted from dealing in this way with any convex spherocylinder whose lower axis is more than about +2·5 D. We are obliged in such cases as +10·0 D. sph. +2·0 D. cyl. ax. 180°, as may be required in aphakia, to make the ocular surface a toric one on base −6·0 D.; *e.g.*,

$$\frac{+18{\cdot}0 \text{ D.}}{-6{\cdot}0 \text{ D. cyl. ax. } 180^\circ - 8{\cdot}0 \text{ D. cyl. ax. } 90^\circ}$$

The ocular surface is, of course, not correct but it is the best that can be made with the present tools; there is, however, a far graver error in the prescription which is inexcusable because it can be rectified.

The thickness of the meniscus is roughly given by Mr. Laurance's simple formula for a 40 mm. lens: $t = 1 + 0{\cdot}4\ (D) = 1 + 4{\cdot}8$ mm. $= 5{\cdot}8$ mm.

Where D=12 in the vertical axis the power of the lens is +12·41 D. as if placed 5·5 mm. in front of its true position, its *effectivity* is that of a lens of power +13·32 D. placed 13·6 mm. from the cornea. The anterior surface of the meniscus is far too convex; the patient would not only fail to see distinctly but he would complain of a distressing curvature of the field. The true anterior curvature, as given in my book, p. 73, is the value of d_1, where $d_1 = \frac{\mu\,(D_b - d_2)}{\mu + (D_b - d_2)\,t.}$ Here we may take the *effective* power of the required lens (D_b) placed 13·6 mm. from the cornea, *i.e.*, at the back surface of the lens) as +11·0 D., as it is the mean between +10·0 D. and +12·0 D.; and similarly $-d_2$ as 7·0 D. The thickness t is 0·0058 m. for the unit in dioptric formulae must be metric. We have then

$$d_1 = \frac{1{\cdot}523(18)}{1{\cdot}523 + 18(0{\cdot}0058)} = \frac{27{\cdot}414}{1{\cdot}6274} = 16{\cdot}84.$$

Practically, it is always better to give a glass that is a trifle weaker,

than a trifle stronger, than is necessary to avoid curvature of the field, so the prescription should be written

$$\frac{+16{\cdot}75 \text{ D. sph.}}{-6.0 \text{ D. cyl. ax. } 180^\circ - 8{\cdot}0 \text{ D. cyl. ax. } 90^\circ}$$

This meniscus would have practically the effectivity of the required spherocylinder +10·0 D. sph. +2·0 D. cyl. ax. 180° This example will show the great importance of the thickness of the lens in high powered convex menisci. A glance at the table will indicate roughly the power required for the convex surface without this tedious calculation. A periscopic of +11·0 on a −6·75 D. base requires a +16·697 D. anterior surface, so on a −7·0 D. base will require roughly a +16·697+0·25 or a +16·847 D. anterior surface. Indeed, unless the patient can wear the glasses very close to his eyes the previous prescriptions should be made 0·25 D. weaker; so that even the length of the eyelashes must be considered for the really accurate prescription of periscopic menisci.

After a cataract operation there is almost always a certain amount of induced astigmatism, requiring a positive cylinder with its axis horizontal; in the course of two or three months this astigmatism usually diminishes. Suppose that +10·0 D. sph. +2·0 D. cyl. ax. 180° is required. It saves expense if a biconvex +9·5 D. is ordered to be tilted downwards about 23°. On referring to the little table, p. 69 of my book, it will be seen that 25° is too great and 20° is too small an angle. It is unnecessary to find the angle accurately as when the glasses are worn the patient will look through them at varying angles. I have always adopted this device for the first temporary glasses, and after five or six months, when the eyes have settled down, ordered the permanent glasses. If there be no astigmatism, it is a great help to order a meniscus with a concavity of −4·5 D. or so for reading purposes; they will be able to read without moving their head for every line. In such cases bifocals are of great advantage, when carefully fitted. The ocular surface for distance will be about −6·75 D. or −7·0 curvature, and if the reading wafer be cemented to the lower part of the concave surface but does not extend to its lower edge, the patient will have a fair periscopic field for reading, and will still be able to see steps through the lower edge when going up or down stairs.

Bifocals are unsatisfactory for aphakic patients who require a cylindrical correction, as the reading wafer must be attached to the convex surface, which makes the meniscus of the wrong shape for reading. As the object of a periscopic lens is to enable one to see distinctly when looking obliquely through it, tilting a periscopic lens will not correct astigmatism against the rule, though I have heard this suggestion made.

As expressed elsewhere I do not recommend bifocals for myopes unless of very low degree. In two years I had two patients with a myopia of less than -6·0 D. who acquired a detached retina after wearing bifocal lenses, one pair having been prescribed by myself.

CONVEX PERISCOPIC LENSES OF WIDTH 40 mm.

Solid angle of 60°, $\mu = 1{\cdot}523$.

	Distance.			30 cm. from Spectacle Frame.	
D.	t. in mm.	Ant. Surf.	Ocul Surf.	Ant. Surf.	Ocul. Surf.
+ 1·0	1·38	+ 7·449 D.	- 6·5 D.	+ 4·977 D.	- 4·00 D.
+ 2·0	1·77	+ 8·417 D.	- 6·5 D.	+ 6·206 D.	- 4·25 D.
+ 3·0	2·20	+ 9·371 D.	- 6·5 D	+ 7·175 D.	- 4·25 D.
+ 4·0	2·54	+ 10·560 D.	- 6·75 D.	+ 8·138 D.	- 4·25 D.
+ 5·0	2·93	+ 11·490 D.	- 6·75 D.	+ 9·088 D.	- 4·25 D.
+ 6·0	3·33	+ 12·641 D.	- 7·00 D.	+ 10·264 D.	- 4·50 D.
+ 7·0	3·73	+ 13·536 D.	- 7·00 D.	+ 11·421 D.	- 4.75 D.
+ 8·0	4·14	+ 14·413 D.	- 7·00 D.	+ 13·022 D.	- 5·50 D.
+ 9·0	4·55	+ 15·270 D.	- 7·00 D.	+ 13·668 D.	- 5·25 D.
+ 10·0	4·98	+ 16·105 D.	- 7·00 D.	+ 14·299 D.	- 5·00 D.
+ 11·0	5·41	+ 16·697 D.	- 6·75 D.	+ 15·140 D.	- 5·00 D.
+ 12·0	5·86	+ 17·488 D.	- 6·75 D.	+ 15·956 D.	- 5·00 D.
+ 13·0	6·32	+ 17·826 D.	- 6·25 D	+ 16·532 D.	- 4·75 D.
+ 14·0	6·79	+ 18·152 D.	- 5·75 D.	+ 17·090 D.	- 4·50 D.

CONCAVE LENSES OF NEGLIGIBLE THICKNESS.

- 1·0	+ 6·25 D.	- 7·25 D.	+ 4·25 D.	- 5·25 D.
- 2·0	+ 5·75 D.	- 7·75 D.	+ 3·75 D.	- 5·75 D.
- 3·0	+ 5·00 D.	- 8·00 D.	+ 3·25 D.	- 6·25 D.
- 4·0	+ 4·75 D.	- 8·75 D.	+ 2·50 D.	- 6·50 D.
- 5·0	+ 4·25 D.	- 9·25 D.	+ 2·00 D.	- 7·00 D.
- 6·0	+ 3·75 D.	- 9·75 D.	+ 1·50 D.	- 7·50 D.
- 7·0	+ 3·25 D.	- 10·25 D.	+ 1·00 D.	- 8·00 D.
- 8·0	+ 2·75 D.	- 10·75 D.	+ 0·50 D.	- 8·50 D.
- 9·0	+ 2·25 D.	- 11·25 D.	Plane	- 9·00 D.
- 10·0	+ 2·00 D.	- 12·00 D.	- 0·50 D.	- 9.50 D.
- 11·0	+ 1·50 D.	- 12·50 D.	- 1·00 D.	- 10·00 D.
- 12·0	+ 1·25 D.	- 13·25 D.	- 1·25 D.	- 10·75 D.
- 13·0	+ 1·00 D.	- 14·00 D.	- 1·75 D.	- 11 25 D.
- 14·0	+ 0·75 D.	- 14·75 D.	- 2 00 D.	- 12·00 D.
- 15·0	+ 0·50 D.	- 15·50 D.	- 2·00 D.	- 13·00 D.
- 16·0	+ 0·25 D.	- 16·25 D.		
- 17·0	Plane	- 17·00 D.		
- 20·0	Plane	- 20·00 D.		

BRITISH MASTERS OF OPHTHALMOLOGY SERIES

21.—WILLIAM CHESELDEN, 1688-1752

BY

R. R. JAMES

LONDON

No apology is needed for including a brief account of Cheselden in the British Masters of Ophthalmology Series. He was a master of the surgical craft and to him we owe the origin of the operation of iridotomy.

He was born at Somerby, Leicestershire, on October 19, 1688. It has been stated that he began the study of his profession in Leicestershire, but if this be so he must have started extremely young, for we know that in 1703 he was a pupil of the celebrated anatomist, William Cowper, and that on December 7, 1703 he was apprenticed, for the usual term of seven years, to James Ferne, Surgeon to St. Thomas's Hospital. On December 5, 1710, he was admitted to the Freedom and Livery of the Barber-Surgeons' Company; and he was lecturing on his own account in London in 1711. Details of his career as an anatomical teacher will be found in Dr. George Peachey's *Memoir of William and John Hunter*. Peachey mentions that he has seen a copy of Cheselden's *Syllabus of Anatomy in* 35 *Lectures*, for the use of his Anatomical Theatre, 1711; and in a foot-note states that this is the earliest syllabus he has seen bearing the name of a private lecturer, and separately printed.

In 1712 Cheselden was elected F.R.S. Two years later, in March, 1714, we find him in trouble with the Barber-Surgeons' Company. At the March Court the Master acquainted the Court that " Mr. Cheselden, a member of this Company, did frequently procure the dead bodies of malefactors from the place of execution and dissect them at his own house, as well during the Company's public lectures as at other times, without the leave of the Governors, and contrary to the Company's by-law in that behalf: by which means it became more difficult for the beadles to bring away the Company's bodies, and likewise drew away the members of the Company and others from the public dissections and lectures at the Hall: the said Mr. Cheselden was thereupon called in, but having submitted himself to the pleasure of the Court with a promise never to dissect at the same time as the Company had their lecture at the Hall, nor without leave of the Governors for the time being, the said Mr. Cheselden was

excused what had passed, with a reproof for the same pronounced by the Master at the desire of the Court."

Before this, in 1711, he had been granted the full certificate entitling him to practise. In 1719 he was elected Surgeon to St. Thomas's Hospital and he served there as surgeon for 19 years. But he did not immediately relinquish his work as an anatomical teacher, for Peachey finds an advertisement in the *Daily Courant* of March 21, 1721, of a new course of anatomy with comparative anatomy, to be given by Cheselden and Francis Hawksbee. The notice ends as follows:— "N.B. This course being chiefly intended for gentlemen, such things only will be omitted as are neither instructive nor entertaining, and care will be taken to have nothing offensive."

In 1727, Cheselden married Miss Deborah Knight, of London, of which union the sole issue was a daughter. In this year also he published his great surgical improvement of lateral lithotomy for vesical calculus. Two years later, in 1729, we find him admitted a Corresponding Member of the Royal Academy of Sciences of Paris, a very high honour for a surgeon; and on the institution of the Royal Academy of Surgery of Paris he had the honour of being the first foreigner elected a member of that body.

To go backwards a couple of years, we find, that in 1727, he was chosen Principal Surgeon to Queen Caroline; and in 1728 he gave his account of iridotomy to the world. His description is as follows:—

" A knife passed through the tunica sclerotis, under the cornea before the iris, in order to cut an artificial pupil where the natural one is clos'd. This operation I have perform'd several times with good success; indeed it cannot fail when the operation is well done, and the eye not otherwise diseas'd, which is more than can be said for couching a cataract. In this operation great care must be taken to hold open the eye lids without pressing upon the eye, for if the aqueous humour is squeez'd out before the incision is made in the iris, the eye grows flaccid and renders the operation difficult." Cheselden has also described an operation for excising a portion of a proptosed cornea, and says: " This operation is very useful, and attended with but little pain."

When St. George's Hospital was founded in 1733, it was fortunate in securing the services of Cheselden as Principal Surgeon, and to him was entrusted the cutting for stone. At the same time John Ranby, also Surgeon to St. Thomas's Hospital and Serjeant Surgeon to the King, was elected to attend to the cataract cases at St. George's. Cheselden retired from St. George's in 1737 in which year he was elected surgeon to Chelsea Hospital, which latter post he filled till his death.

In 1743, Cheselden was chosen one of the Sheriffs for London and Middlesex, but he swore off. The following is from the journals kept in the Town Clerk's office: "28, June 1743. Willimot, Mayor. William Cheselden, Esq. citizen and Barber-Surgeon, appeared, with six other citizens (all Barber-Surgeons), before the Court of Aldermen, and did then and there take his and their corporal oaths, that he, the said William Cheselden, was not of the estate, in lands, goods, and separate debts, of the value of £15,000; he was thereupon discharged from the office of Sheriff, to the which he had been elected, on the 24th inst." This is taken from Wadd's *Memoirs and Maxims,* where it is also recorded that Cheselden once received a fee of 200 guineas for a visit to Chester with an operation for lithotomy there.

In 1745 he was elected Junior Warden of the Barber-Surgeons' Company. This was the year of the separation of the Barbers and the Surgeons and on the foundation of the Company of Surgeons, he was chosen one of the Wardens of the new Company. In 1746 he was elected Master of the Company of Surgeons and served that office for a year.

Cheselden was a patron of the arts; Wadd states that the plan of Fulham Bridge was drawn by him. He was also a patron of boxing and sports generally. His disposition was gay and genial, he was popular with all, and had the reputation of always being kind to his patients. He lives in Pope's famous line:—

"I'll do what Mead and Cheselden advise."

Peachey tells us that Cheselden had an apoplectic stroke in 1751; he died at Bath, April 10, 1752. The notice in the *Gentleman's Magazine* adds that death was accelerated by his taking ale on the top of hot Bath buns!

Cheselden's will is one of the briefest on record: "Being in perfect health I write this with my own hand and declare it to be my last will and testament. I give to my daughter W. J. Cotes £500 and all the rest and residue of my estate of what kind soever to my wife and make her full and sole executrix, administratrix and assign. Witness my hand and seal. Willm. Cheselden. 24 March 1749/50."

The very fine collection of book-plates of medical men owned by my friend, Dr. George Peachey, contains a specimen of the armorial plate of Cheselden which is in the Chippendale style. His book-plate shows that he came of an armigerous family.

His portrait is one of the most striking pictures in the Council Room of the Royal College of Surgeons, and there is a very fine mezzotint engraving of it, which is scarce.

ANNOTATION

The Gift of Experience

This gift, according to Harold Gifford, is the great possession of the " old man in medicine." Too often it is ruthlessly thrown away by its owner when he retires, either to a place where there is traditionally no disease or to a devotion of the remaining years of his life to some pursuit other than medical. The process of acquiring this experience has then to be gone through again by the younger generation who in their turn throw it away. It seems a pity that there should be this waste of carefully garnered and sifted information, and that some broadcasting of their experience should not be customary for those who are retiring from practice. It might be possible, for example, for an eminent ophthalmic surgeon of ripe experience to embody the most valuable parts of this in an article not necessarily limited to one particular part of ophthalmology. Such an article has recently been written by the younger Gifford (*Arch. of Ophthal.*, July, 1930), on the practical procedures used by his father, and it contains a host of useful tips, among which are the following. " In pterygia, small epibulbar tumours or dermoid cysts of the lids, he would often transfix the growth with a suture on which gentle traction was made while the dissection was done. Such little growths as were suspected of malignancy were usually outlined with a fine electrocautery point before removal so as to avoid inoculation of healthy tissue with the knife. Their base was thoroughly cauterized after removal." A large conjunctival flap was obtained in cataract operations by injecting a little cocaine at the site of the puncture and allowing a few drops of aqueous to escape subconjunctivally before the conjunctiva was counterpunctured. With this method of operating, iris prolapse was rare, and when it occurred was subconjunctival. It was dealt with by injecting cocaine to produce oedema round the prolapsed part and introducing a fine knife through the conjunctiva and iris into the anterior chamber. The knife was turned a little before being withdrawn. Iridotomy was performed with a narrow cataract knife inserted at the limbus in the horizontal meridian and stabbed quickly through the iris beyond its centre. The knife was withdrawn by a quick sawing pull and a good central gap resulted. Instead of performing a Mules' operation, Harold Gifford used to open the eye by a horizontal incision with a cataract knife through the cornea and ciliary region, remove the contents and leave the cornea in place, simply pressing it back against the sclera by means of a sponge covered with zinc oxide ointment and placed between the lids.

The resulting stump was just as good as that obtained by any other method. Some of these procedures are probably well known to readers of this article but the fact that they have stood the test of long experience is a guarantee of their efficacy for those who have not tried them.

Similar articles by other ophthalmic surgeons describing procedures which have stood the test of time would be of immense value to the younger school and well worthy of publication.

ABSTRACTS

MISCELLANEOUS

(1) **Ridley, F. (London).—The intra-ocular pressure and the drainage of the aqueous humour.** *Brit. Jl. of Exper. Pathol.*, Vol. XI, pp. 217-240, 1930.

(1) After a critical examination of existing theories **Ridley** concludes that the evidence does not justify the belief that the aqueous drains into the scleral veins via Schlemm's canal or into the capillaries of the iris. The experiments upon which Leber based his conclusion that the cornea is impermeable are also challenged.

A series of experiments upon excised eyes and upon the living eye in the anaesthetized rabbit is advanced to show that the normal cornea is permeable in both directions to water and diffusible substances in solution and that this permeability is most marked at the periphery. Impregnation of the cornea with dyes or silver salts shows that the cornea extends to the root of the iris and that the pectinate ligament is opposed to corneal tissue.

Previous work upon the aqueous is briefly reviewed and the view that it is formed by dialysation is supported. Recent work by Adair upon the " activities " of ions in physiological fluids is advanced in opposition to Duke-Elder's view that a Donnan equilibrium has been demonstrated between the blood and aqueous; the latter's conclusion that there is normally no drainage of the aqueous is disputed.

Tears are next examined in the same light. An analysis of tears shows that the diffusible constituents of blood are present in similar proportion and the osmotic pressure of tears was found to be a little less than that of the blood. The salt content of tears is only 0·658 per cent. while the protein is as high as 0·669 per cent. The sugar content is given erroneously as 0·65 per cent; this should read 0·065 per cent. Under carefully reconstructed physio-

logical conditions in the recently excised eye the flow of fluid through the cornea was found to be 0·87 c.mm. per minute at 25 mm. Hg and 1·13 c.mm. per minute at 50 mm. Hg pressure. These figures are in agreement with Friedenwald's figures for the formation of aqueous in the living eye.

Ridley concludes that the cornea is permeable to all the constituents of the fluids bathing it except protein, that these fluids are of similar composition and osmotic pressure, that the intra-ocular pressure constantly forces fluid through the cornea and that this is assisted by the osmotic pressure and properties as regards surface tension contributed by the tears' protein.

Since the contents of the globe are incompressible change of intra-ocular pressure can arise only by change of volume of globe contents apart from extraneous pressure upon the globe, and the intra-ocular pressure at any moment is determined by the tension created in the scleral wall by its distension to the volume of globe contents. Ridley concludes that change of blood volume in the eye, alone, determines change of intra-ocular pressure within a short space of time. The change of pressure to which a given volume change would give rise can be determined by reference to curves of distensibility reproduced. From these curves the volume of blood normally present in the eye can be deduced and this was confirmed in the living rabbit by direct measurement. The expansion of which the vascular bed is capable was also determined and it is shown that sudden complete loss of active tone in a normal eye—unaccompanied by a fall in blood pressure—would produce a rise of intra-ocular pressure limited only by the highest vascular pressure existing in the eye. In glaucoma the distensibility curve is very steep and changes of vascular tone may produce abnormally great pressure changes in such eyes; Ridley suggests that tonometric measurements in glaucoma may be excessive for this reason.

The paper proceeds to an examination of the relation between vascular tone, pressure and volume in the eye and this is correlated with the intra-ocular pressure, scleral distensibility and osmotic pressures of the aqueous and blood in a series of six equations. Ridley suggests that if the rate of drainage through the cornea (in which he includes the filtration angle) falls, a point will be reached at which the accumulation of katabolic products in the aqueous, assisted by the fact that diffusion into the ciliary processes is not now antagonized by the outward flow of aqueous, will give rise to loss of active tone in the ciliary vessels. Failure of drainage is thus brought into line with the preceding argument. The factors influencing the rate of drainage through the cornea, namely intra-ocular pressure, corneal permeability and osmotic pressures of aqueous and tears are correlated in three equations

and it is shown that a rise of intra-ocular pressure is the only mechanism by which failure of adequate drainage can be compensated.

Much clinical and experimental experience appears to be satisfactorily explained by this work. The paper is, however, too technical to be conveyed adequately in abstract form.

ARNOLD SORSBY.

(2) **Trubin, Anatol (Baku).—Adhesion of the lens to the cornea as the starting point of a series of developmental anomalies in the eye. (Verklebung der Linse mit der Hornhaut als Ausgangspunkt einer Reihe von Bildungsanomalien des Auges)** *Arch. f. Ophthal.*, Vol. CXIX, 1928.

(2) **Trubin** examined the buphthalmic eyes of an infant aged 11 months, and found (besides congenital abnormalities in the posterior part of the eyes) signs of arrested development in the anterior portion—corresponding to the fifth month of foetal life—together with an adhesion between the lens and the cornea. These latter findings he regards as of primary importance for the study of the pathogenesis of hydrophthalmos congenitus, congenital opacities of the cornea, and anterior lenticonus.

His conclusions are as follow :—

(1) Congenital hydrophthalmos is due to a developmental anomaly in the anterior portion of the eye.

The initial abnormality is the delayed formation of the anterior chamber, due to the adhesion of the lens capsule to the cornea. The consequences of this delayed formation are seen in the absence or imperfect development of Schlemm's canal, and the signs of arrested development in the iris—aniridia, coloboma, and imperfect formation of the mesodermal layer with absence of the crypts.

The closure, or developmental defect, of Schlemm's canal causes an arrest of filtration from the anterior chamber, and thereby a condition of glaucoma. The plasticity of the fibrous coat in the infant eye leads to buphthalmos.

The partial or more frequently complete separation of the lens from the adherent cornea produces the well-known tears in Descemet's membrane, the origin of which is attributed by most authors to excessive growth of the cornea.

(2) Congenital opacities of the cornea, which often occur in cases of buphthalmos, or are seen in the eyes of new-born infants that were later affected with buphthalmos, are caused by an incomplete development of the corneal tissue and embryonic vascularisation, due to its adhesion to the lens.

Another anatomical basis for these congenital corneal opacities is found in the defect in Descemet's membrane, which owes its

origin to the stretching of the synechiae (between iris and cornea) that arise from the iris and are the remnants of the so-called lamina irido-pupillaris.

(3) Signs of an adhesion between the lens and the cornea are seen (in the lens), according to the firmness of the adhesion, in the form of lentiglobus, lenticonus, or pyramidal cataract, which may lose or retain their connection with the cornea, or lastly, sub-capsular cataract at the anterior pole.

THOS. SNOWBALL.

(3) **Abe T., and Komura, K. (Sendai).—Experiments on the changes in the aqueous, with special reference to the influence of closure of the lids upon them. (Experimente ueber den Kammerwasserwechsel, besonders ueber den Einfluss des Lidschlags auf denselben).** *Arch. f. Ophthal.*, Vol. CXXI, p. 304.

(3) **Abe and Komura** found that when fluorescein, which they employed to study the outflow of the aqueous, is introduced into the circulation intravenously, its concentration in the aqueous reaches its highest point 30 to 40 minutes after its injection; it then diminishes, at first slowly, afterwards more rapidly, and still later at a slower rate. The initial rise is due to the diffusion of the fluorescein into the aqueous, and the subsequent fall to its passage outwards through the anterior chamber angle.

The diffusion of the fluorescein into the aqueous does not appear to be very definitely assisted by the closure of the lids, but its outflow from the anterior chamber is markedly accelerated by their action.

In rabbits narcotized with urethane, whereby the pressure of the extra-ocular muscles on the eye was avoided, it was established that the rate of the outflow of the fluorescein from the anterior chamber was enormously retarded.

The rate of outflow of the aqueous in the normal rabbit, according to their experiments, is 4·87 c.mm. per minute, and the time required to fill the anterior chamber once is 62 minutes (when the total content of the anterior chamber in medium-sized rabbits is on the average 0·3 c.cm.)

Theoretically the amount of aqueous passing out per minute in the human eye is reckoned as 3·8 c.mm., and the time required for filling the anterior chamber once is 63 minutes, the total amount of aqueous in human eyes being on the average 0·24 c.cm.

The rate of outflow of the aqueous in the eyes of rabbits, when the action of the lids is increased in frequency, is greatly accelerated, and in eyes with 10 movements of the lids per minute amounts to 8·02 c.mm., so that the difference in the amount of the

aqueous passing out in the eyes of normal rabbits as compared with those with increased action of the lids (3·15 c.mm.) must have been produced by the movements of the lids. One movement of the lids, therefore, increases the outflow by 0·315 c.mm. aqueous.

These facts justify the conclusion that the lid closure must play an important rôle in the mechanism of the exchange of the aqueous.

THOS. SNOWBALL.

(4) **Mächler, Joseph (Zürich).—On the corneal refraction in anisometropia. (Ueber Hornhautrefraktion bei Anisometropie).** *Arch. f. Ophthal.*, Vol. CXX, p. 540.

(4) **Mächler** analysed a series of 67 cases in which there was a difference of at least 3D. in the total refraction between the eyes, giving various tables of these cases according to the presence and degree of direct and inverse astigmatism.

His measurements indicate that in the majority of the cases the curvature of the cornea remains practically the same in both eyes.

A remarkable feature was the asymmetrical position of the principal axes in a comparatively large proportion of the cases.

No rule, however, can be laid down as to the incidence of direct and inverse astigmatism in the individual type of refraction; his figures certainly give no indication that inverse astigmatism, or a tendency to it, specially affects the eye with axial myopia, but they show that the inherited factor (gene), which determines the refraction of the cornea in anisometropes, is to a very large extent independent of the axial refraction of both eyes: one eye may show a very high degree of axial myopia, the other may be emmetropic or hypermetropic, and the corneal refraction may be the same in both.

THOS. SNOWBALL.

(5) **Car, A. and Ortynski, H. (Zagreb).—Experimental research on the influence of extracts of glands with internal secretion on the regeneration of the aqueous fluid. (Experimentelle Untersuchungen ueber die Wirkung der Drüsenextracte mit innerer Sekretion auf die Regeneration des Kammerwassers).** *Arch. f. Ophthal.*, Vol. CXXII, p. 240.

(5) **Car and Ortynski** in this article first review the literature bearing on the various factors that affect the regeneration of the anterior chamber, and then give an account of experiments on rabbits, in which they studied the results of subconjunctival injections of various hormones on the aqueous, as an extension of the work already done on adrenalin, directing their attention to a determination of the refractive index in the first and regenerated aqueous, and an estimation of the protein content.

In place of adrenalin they employed glaucosan, and found that

the refractive index and the percentage of protein in the second aqueous were diminished as compared with the normal eye, while the regeneration of the anterior chamber was delayed and the tension of the eye reduced.

Glanduitrin (pitruitin), it was found, gave a more intense reaction than glaucosan. Parathyroid extract was similar in its action to glanduitrin and adrenalin. Insulin yielded similar, though less marked, results.

In these cases there was no appreciable action on the blood-vessels, so that the diminution in the protein was attributable not only to the vasoconstrictor, but also perhaps to the osmotic and secretory factors in its excretion.

The amount of protein in normal conditions varies between 2·5 and 3·2 per cent. Similar results were obtained with extracts of the thyroid, thymus, testicle and ovary.

THOS. SNOWBALL.

(6) **Beeler, A. (Zürich).—On heterotypical conus, especially inferior conus and the ectasia of the neighbouring portion of the fundus. (Der heterotypische Conus, insbesondere der Conus nach unten und die Ausbuchtung des angrenzenden Augenhintergrundes).** *Arch. f. Ophthal.*, Vol. CXXII, p. 342.

(6) **Beeler** collected and clinically examined 35 cases (62 eyes) of heterotypical conus, and in this paper records his observations.

This condition was bilateral in 27 cases, and apart from a few exceptions in young persons was always associated, even with correcting glasses, with subnormal vision.

The position of the conus was inferior in the great majority of the cases; in a few it was situated below and to the nasal or temporal side. In only two eyes was it on the nasal side.

Its breadth apparently increased with the age of the patient and, as regards the refraction, with a change from hypermetropia to myopia. It was found more frequently in females than in males (26 : 9).

Distinct ectasia of the fundus in the immediate neighbourhood of the conus was noted in a large proportion of the cases, and this ectasia was associated with a relative loss of pigmentation over this area.

Inferior conus, like that in axial myopia, may be followed by an atrophy of the choroid, which progresses with age and with increase in the refraction. The ectasia of the fundus downwards is in this sense comparable with that seen in myopia.

Heterotypical conus, in whatever position it occurs, is as frequently inherited as H. and M. and other refractions, and like the latter may be regarded as a developmental anomaly.

THOS. SNOWBALL.

(7) **Hecht, Selig (New York City).—Visual acuity and illumination.** *Arch. of Ophthal.*, November, 1928.

(7) **Hecht's** article is an attempt to give a theoretical explanation of the relationships observed between visual acuity and illumination. He starts with the reasonable assumption that the resolving power of the retina varies with the average distance between the sensitive elements. It follows, therefore, that as the visual acuity, *i.e.*, the resolving power of the eye, is diminished by low illumination, there must be fewer sensory elements working per unit area, and conversely, that as the illumination increases, more and more retinal elements reach this threshold of illumination so that visual acuity increases, up to a point when all the elements are functional and no further increase is possible. Another way of stating this is to say that the percipient elements of the retina must have different thresholds, so that in low illumination only a few, the most sensitive, will respond to the stimulus, whereas in higher illumination, the less sensitive are also brought into action. Before making this hypothesis strictly quantitative, it is necessary to consider the effect of the size of the pupil on the illumination of the retina. Reeves has provided data for this, in the form of a curve giving the relationship between the pupil area and illumination. Assuming now that the distribution of thresholds of rods and cones follows the usual biometric laws, we can work out the number of rods and cones which are functioning per unit area at any intensity. When this is done, and the curve is corrected for the effect of the pupil, the result is the same as the curve obtained experimentally by observing the relationship between illumination and visual acuity. It is possible, theoretically, to work out one curve for the rods and one for the cones, the complete one representing, of course, the sum of these two. It is interesting to note that in completely colour blind individuals the luminosity acuity follows the curve worked out for rods alone, while in the normal eye, the cones overtake the rods at the middle of the latter's range of acuity. The author then goes on to consider whether there is such a thing as a unit retinal area, and if so, how many elements it contains. Working with the brightness discrimination test, Koenig found that the whole range consisted of 572 distinct steps, about 30 being mediated by the rods and the remainder by the cones. The recognition of the "step" presumably means the stimulation of an additional element. We are, therefore, justified in assuming the existence of 542 cones in our minimal unit retinal area. The problem can be attacked in another way. The lowest visual acuity obtained by diminishing illumination corresponds to a visual angle of slightly over 44 minutes, which represents a distance of 0·2 mm. on the retina. The minimal area would thus be 0·04 sqr. mm., an area

which histologically has been found to contain 540 cones. Finally, if Young's theory of colour vision be true, the same result is obtained by the following inductive process. There are three kinds of cones, sensitive respectively to red, green and blue. Now, if there are 540 cones per unit area and the number of each kind is equal, there must be 180 of each. If discrimination of a spectral hue involves on the average a change in one of each species of cone, then the number of monochromatic patches obtainable with a spectrum should be 180, a figure which agrees remarkably well with what has been found by experiments performed by various observers.

F. A. W-N.

(8) **Blank, Adolf (Vienna). — Investigations on the bacterial content of normal corneae. (Untersuchungen ueber den Keimgehalt normaler Hornhäute).** *Arch. f. Ophthal.*, Vol. CXXII, p. 661.

(8) This research by **Blank** on the bacteria found on the surface of the normal cornea and their relation to those on the surrounding normal conjunctiva was carried out on patients over 40 years of age, because this question is of special importance in elderly people who require operation for cataract or glaucoma, and because the bacteria found in the normal conjunctiva and cornea are more numerous in elderly persons than in young individuals.

It was found that the conditions in the two eyes of the same patient were frequently different.

In a large proportion of the eyes the bacteria on the cornea and on the conjunctiva were the same, viz., pneumococci either alone or with staphylococci and/or xerosis bacilli.

In only a few cases were pneumococci found on the cornea alone, but absent in the conjunctival sac.

With few exceptions the bacteria derived from the surface of the cornea grow more sparingly than those obtained from the conjunctiva.

These tests confirm the view that besides staphylococci and xerosis bacilli, chain-forming cocci (which for the most part are probably pneumococci) live as saprophytes in the conjunctival sac and frequently, perhaps in all cases, on the cornea of normal eyes, especially in elderly people, but that it is probably in many patients impossible to demonstrate their presence.

THOS. SNOWBALL.

(9) **Holloway, T. B., and Fry, W. E. (Philadelphia).—Asteroid hyalitis.** *Arch. of Ophthal.*, November, 1929.

(9) The term asteroid hyalitis is applied to the formation of snowball opacities in the vitreous, an appearance first described by Benson in 1894. Examination of these bodies has already been

made by Verhoeff and by Bachstez whose findings agree in the main with those reported in this paper. **Holloway** and **Fry's** case was a man aged 69 years, who had a trephining done for acute glaucoma and died 12 days later from coronary thrombosis and broncho-pneumonia. The eye was enucleated one hour after death. It is interesting to note that a ciliary process was pulled forward and was adherent to the trephine opening, and that the anterior part of the choroid was detached from the sclera by a uniform homogeneous exudate. The rod and cone layer of the retina had degenerated but other layers were present. The snowball-like opacities which had been observed *ante mortem* in the vitreous, were most numerous in the lower part of the anterior two-thirds of the globe. The majority of them formed a column-like arrangement, beginning just anterior and slightly internal to the ora serrata, curving in a slight arc inwards and backwards for a distance of .6—8 mm., where the arrangement, became less regular. By transmitted light they appeared nearly black and by reflected light they appeared as snow-white spheres, varying from 0·08 to less than 0·01 mm. in diameter. They were firm enough to resist crushing between slides and gave reactions indicating the presence of a carbonate, calcium, a sterate or a palmitate or both and probably lipoids in combination.

F. A. W-N.

(10) **Brinton, A. G. (Johannesburg).—The frequent association of diseases of the eye with pathological conditions of the tonsils and sinuses.** *The Jl. of the Med. Assoc. of South Africa* (B.M.A.), October 26, 1929.

(10) **Brinton,** in a communication delivered at the International Congress of Medicine in London in 1913, drew attention to the striking results he had obtained in cases of spring catarrh by enucleation of the tonsils. In his present article, he emphasizes the importance of infected tonsils and sinuses as causative factors in ocular troubles and diseases.

In addition to asthenopia almost every structure of the globe is mentioned as being liable to either direct or indirect infection arising from these sources.

One case is given in some detail and is of interest.

A young girl whose vision, both central and peripheral, failed suddenly and almost totally, was found to have optic neuritis in each eye.

No cause was found other than septic tonsils, which were enucleated ten days after the onset of the trouble, and within a week after being first seen.

In three days a striking improvement in vision followed, and after two months, during which time an autogenous vaccine was

used, the vision was normal in each eye with a full field and the fundi presented a normal appearance.

The paper is of value inasmuch as the importance of neighbouring foci of infection should never be forgotten in almost any ocular inflammation, but it would have been of even more value if the author had generalized less and given fuller details of more cases in support.

A further paper by him on the effects of tonsillar enucleation in cases of spring catarrh would be welcomed.

BERNARD CRIDLAND.

(11) **Rossi, Domenico (Florence).—Clinical and histological researches on the experimental infection and re-infection of the eye with tubercle.** *Boll. d'Ocul.*, October, 1929.

(11) After giving a short résumé of the literature of experimental infection of rabbits' eyes, **Rossi** describes his own technique and results, illustrated by microphotographs.

In the first series of experiments he inoculated the eyes of healthy rabbits, while in the second series (that which he refers to as re-infection) the eyes inoculated were those of rabbits into which tubercle bacilli had been introduced under the abdominal skin two months before. The object of his experiment is to show that the clinical course of the tuberculous eye lesions differs in the two cases, as well as their histological details: he found epithelioid cells only, in tuberculous foci of the first series, whereas in those of the second, both epithelioid and giant cells were present.

LESLIE PATON.

(12) **Pearson, K. and Usher, C. H.—Albinism in dogs.** *Biometrika*, Vol. XXI, Pts. 1-4.

(12) **Pearson** and **Usher** have continued through many years a research on the experimental breeding of dogs, begun by them in conjunction with the late Edward Nettleship in 1905. Their labours are still unfinished but they are now able " to report on one aspect of the investigation, viz: Albinism in Dogs." The original stock consisted of Albino Pekinese and pure-bred black Pomeranians, and in successive generations three types of Albino dogs were obtained, called respectively the Dondo or White Albino (the commonest form), the Cornaz Spaniel, and the Skewbald.

There are 19 pages of letterpress, eight full-page plates, of which two are in colours, and two long pedigrees in this paper. It teems with facts and observations arranged with the meticulous care which characterizes the published work of the two authors. The results they have achieved and their presentation

of them would have been most gratifying to their early collaborator Nettleship. For the years of continuous work and observation, of which this paper is but a limited record, the authors deserve much praise. The tale is one which cannot be told intelligibly in an abstract, and we can but counsel a study of the original. The printing and plates are extremely well done, as is usual in this journal.

J. B. LAWFORD.

(13) **Kiso, Keigo (Tokio).—Contributions concerning the inheritance of opaque nerve fibres of the retina. (Beiträge zur Kenntniss von der Vererbung der markhaltigen Sehnervenfasern der Netzhaut).** *Arch. f. Ophthal.*, Bd. CXX, April, 1928.

(13) This is an exhaustive paper on the subject. There are a dozen fundus pictures reproduced in black and white.

Kiso summarizes as follows:—

1. Six cases of opaque nerve fibres have been ascertained in one family. This provides an important basis to our understanding of the inheritance of the anomaly.

2. . . . . in most cases of uncommonly extensive opaque nerve fibres, other kinds of congenital anomalies also occur.

3. In the four cases without other congenital anomalies discovered in Japan, congenital luetics were concerned. Therefore, an acquired condition could be a cause for the occurrence of extensive opaque nerve fibres.

4. As regards the complications, a great difference between the extensive and minor forms of this anomaly is noticeable and the frequent occurrence of complications in the minor forms is not accidental.

5. Both forms are caused by one and the same inheritance factor.

6. One may assume that the inheritance factor lies in the X-chromosome. The decision on the point is best left to further investigation.

D. V. GIRI.

(14) **Incze, A. (Budapest).—On the correct measurement of the blind spot. (Ueber die richtige Bestimmung des blinden Fleckes).** *Arch. f. Augenheilk.*, Bd. XCIX, November, 1928.

(14) This contribution is based on the determination of the blind spot in healthy emmetropic eyes of 33 individuals of 20 to 24 years of age, at a distance of 1 m. from the Bjerrum screen with a test object 0·5 cm. in diameter. In each case the boundary of the blind spot was defined in two ways:

(1) by moving the test object from the seeing into the blind area and out of the latter again into the seeing;

(2) by moving the object from the blind area into the seeing. The area mapped out by the first method was smaller than that defined by the second.

Of the 33 cases, in 13 the blind spot was an absolute scotoma and in the remaining 20 there were faintly percipient parts.

Incze concludes that the correct boundary of the blind spot is the one obtained by moving the test object from the blind into the seeing area and that the smaller blind spot mapped out by the reverse process is an artefact.

In practice he recommends the charting of the blind spot by both methods as the extent of the relatively blind area between the two boundaries is often of diagnostic value.

D. V. GIRI.

(15) **Charamis, J. S. (Paris).—Abnormal forms of the Marcus Gunn phenomenon. (Formes anormales du Phénomène de Marcus Gunn.)** *Arch. d'Ophtal.*, November, 1929.

(15) The functional connection between the movements of the upper eyelid and those of the lower jaw was noted by Marcus Gunn in 1883. Almost half a century has passed and the aetiology of the phenomenon is still obscure. In 1925, Villard found 93 cases on record; since that date a few have been published chiefly by French observers. **Charamis** gives briefly the varied hypothetical explanations of the phenomenon, but repetition of them is scarcely necessary; actually the pathogenesis of the condition is unexplained, but as Villard remarks, this ignorance is not very surprising when we remember that in the whole series of reported cases, there is not one in which the clinical observation has been supplemented by a necropsy.

The condition, as originally described, is characterized by congenital unilateral ptosis, usually incomplete, and uninfluenced by voluntary effort. Opening of the mouth is accompanied by elevation of the drooped eyelid, increasing as the mouth is more widely opened.

The abnormal forms (that is forms more or less at variance with Gunn's description) have been divided into three groups according to their relation to the muscles innervated by the facial, the glossopharyngeal or the oculo-motor nerve. Generally, this grouping seems adequate; we find in the literature cases in which the phenomenon is induced by the action of muscles innervated by the fifth, seventh and twelfth nerves.

Since Villard's paper some observations have been published of cases still more paradoxical and complex. Benoit (1926), describes a case of an inverse syndrome, *i.e.*, one in which movement of the lower jaw *induced* ptosis. This patient was the subject of facial paralysis and Benoit suggests as an explanation

the existence of peripheral anastomosing filaments innervating the fibres of the paralysed nerve.

Fromaget and Brun (1926), report a complex case in a young man with complete right-sided ptosis. Contraction of the elevators of the lower jaw, and lateral movements of it, were accompanied by raising of the drooped eyelid; contraction of the orbicularis palpebrae, closing the lid on the left (sound) side also caused the right upper lid to be raised.

Dupuy-Dutemps (1929, records a case of Gunn's phenomenon in which with the mouth open (and consequently the affected eyelid raised), movement of the jaw to the side of the ptosis induced lowering of the lid. With the mouth closed protrusion of the chin and lateral movements of the jaw provoked the usual phenomenon.

A similar case has been observed by Leri and Weil (1929). Charamis's case, illustrated by six photos, showed a functional connection between the levator palpebrae and almost all the muscles concerned in mastication and in the movement of the skin of the face. The man had almost complete right ptosis, and paresis of the superior rectus on the same side. On opening the mouth to its full extent, the lid was raised so that the whole of the cornea was exposed, but if the jaw was passively lowered no elevation of the lid occurred. With the mouth closed, protrusion of the chin induced elevation of the drooped lid; the same movement was observed if, with the mouth still closed, the teeth were forcibly pressed together. Lateral movements of the jaw to either side corrected the ptosis. With the mouth gently closed, opening the lips, to show the teeth, induced elevation of the eyelid though to a less extent than with jaw movements. Deglutition of solids and fluids, the mouth being closed, caused the lid to be widely opened.

Charamis's patient was one of two survivors of a sibship of five. There was a history of ptosis in the father (dead) and the living brother was the subject of ptosis, of less degree than the patient.

Villard in his paper states that only four instances of heredity of the Marcus Gunn phenomenon were on record: since that date one by Leri and Weil and the author's case have come under observation.

Terrien, in whose clinic this case occurred, has expressed the opinion that in all patients with congenital ptosis the Marcus Gunn phenomenon is present in slight degree but is usually unnoticed.

J. B. LAWFORD.

BOOK NOTICES

Le Trachome. By Med. Lieut.-Col. G. WORMS (Paris) et Med. Command. J. F. MARMOITON (Alger). Paris: Vigot Frères. 1929.

This is the third monograph on trachoma by French authors to be reviewed in these columns within a period of six months. As a means of getting an insight into this kaleidoscopic disease it cannot be compared with the book by Morax and Petit, or that by Cuenod and Nataf. These two books have entirely superseded previous publications on trachoma in any language. The authors append a long bibliography but show little evidence of having consulted many of the volumes detailed therein.

The " ocelles limbiques " described by Bonnet in 1927 were first fully studied by Herbert and printed in the *Trans. Ophthal. Soc. U.K.* 23 years before the French publication, since when their importance as the corneal manifestation of trachoma, has been recognized, while the depressions they leave after scarring are known as " Herbert's peripheral pits " wherever trachoma is rife and the history of trachoma is studied.

The authors do not agree that the existence of trachomatous infiltration of the lacrymal sac has been established, but they do not refer to the demonstration at the Oxford Ophthalmological Congress of five microscopical sections of lacrymal sacs excised from different patients with dacryocystitis, each showing trachoma follicles, and one hyaline degeneration (MacCallan and Sobhy, *Trans. Ophthal. Soc. U.K.*, 1922, p. 280).

The chapter on the prophylaxis of trachoma is a valuable one: the importance of this subject can hardly be realized by ophthalmologists who live in countries where there is no trachoma problem.

The section on treatment naturally describes in detail the method of using diathermy which was introduced by Worms in 1924. The general opinion about this method of treatment is that it is highly experimental and should in no case be applied by any one who is not a specialist in electro-therapeutics.

The section on operations for trichiasis and entropion does not describe van Millingen's grafting operation, nor Saunders's combined excision of tarsus and conjunctiva both of which are essential to have at command in a trachomatous country, as well as the operation first performed by Streatfeild at the Royal London Ophthalmic Hospital in 1857, at a time when its reputed author, Snellen, had not as yet specialized in ophthalmology.

Government Ophthalmic Hospital, Madras, Report for 1929. Madras: Government Press. Price, one rupee, eight annas.

This hospital contains 170 beds and ministers to about 290 old and new out-patients per day. The cataract extraction operations performed numbered 1,675, and the operations for glaucoma were 188. The number of trachoma cases seen was 763, of which only 15 required some form of minor operation; while entropion, the common sequela of trachoma, only required operation in 36 cases.

In cataract operations, the author of the Report, Lieut-Col. Wright, obtains akinesis by the injection of novocaine and adrenalin into the stylo-mastoid foramen to block the seventh nerve.

He advocates the use of adrenalin in the preliminary treatment of bad cases of glaucoma. He states that he obtains a slow fall of tension after some hours of continuous application of adrenalin. This is preceded by an increase of tension and dilatation of the pupil. This first effect was noted in the *Trans. Ophthal. Soc.*, Vol. XXIII, 1903, pages 374—384, by MacCallan, who seems to have thought that in acute and sub-acute glaucoma adrenalin should be used with caution and only in combination with miotics.

An epidemic of superficial punctate keratitis again occurred in 1929, its maximum severity being in the months of September and October. An article on the clinical manifestations of this condition by Wright appeared in the June number of this Journal.

The most serious cause of preventable blindness among children in Madras is keratomalacia. Radium treatment of trachoma and of spring catarrh was found to be of no value.

Die Krankheiten der Orbita. By A. BIRCH-HIRSCHFELD (Königsberg). II Teil, IX Band, XIII Kapitel, I Abt., I Teil of Graefe-Saemisch Handbuch der Gesamten Augenheilkunde. Pp. 1048. 112-114 Lieferung, 1907; 167-170, 1909; 268-269, 1915; 270-273, 1915; 350-373, 1920; 491-492, 1930.

Pulsierender Exophthalmos, being II Teil of above volume. By C. H. SATTLER (Königsberg). 334-349 Lieferung, 1920. Pp. 268. Berlin: Julius Springer.

It was Mark Twain who observed that when the literary German dives into a sentence, that is the last one is going to see of him till he emerges on the other side of the Atlantic with his verb in his mouth. Those who are acquainted with the stupendous Graefe-Saemisch Handbuch know that the ophthalmological German loves swimming in deep and baffling waters, no less than does his literary brother. Birch-Hirschfeld has emerged from the orbit into which he plunged 25 years ago; the first section of his monograph on the diseases of the orbit appeared in 1907 and

the last has just come through. In a concluding remark the author finds it necessary to apologize for the incompleteness of his book of 1,048 closely printed pages, and to explain why there are so many gaps. It must be admitted that the explanations are more convincing than the demonstration of the existence of these gaps.

About a quarter of the book is devoted to changes in the position of the globe within the orbit. The different varieties of enophthalmos are discussed as painstakingly as the more common conditions associated with exophthalmos, pulsating exophthalmos not being considered, for a special monograph of over 250 pages is devoted to it. The section on enophthalmos, apart from surveying the literature on the subject, probably constitutes a complete abstract of all the published cases, set out in tabular form. The second 250 pages deal with inflammations of the orbit; orbital oedema, pseudo-tumours of the orbit, cavernous sinus thrombosis, as far as it involves the orbit, also being considered. Cysts, teratomata, the innocent and malignant tumours of the orbit take up another 250 pages. Shorter sections are 115 pages devoted to injuries, 20 pages to parasitic infections and 32 pages to haemorrhages in the orbit.

Of the completeness and defects of a book on such a scale it is hardly likely that anyone apart from the author can judge effectively. That it constitutes more an abstract of the existing literature on the subject than a unifying survey is admitted by the author, whose apology consists of the statement that our knowledge of orbital affections is clinical and fragmentary rather than pathologically complete. The defects of the book are, therefore, inherent in the subject, and if its information is at times a burden on the memory rather than an illumination of the mind, the blame can hardly be put on the author, who indeed, has put all ophthalmologists in his debt. No doubt the book has faults, but "beauty that makes holy heaven and air, may have faults from head to feet."

Sattler's monograph on Pulsating Exophthalmos, published in 1920, is an appendix to Birch-Hirschfeld's book. Sattler deals as exhaustively with his subject, but in addition to constituting a complete survey of the subject, his monograph is also a critical treatise. Apart from distinguishing between the traumatic and idiopathic varieties, a clear distinction is also drawn for those cases of exophthalmos in which the pulsation is true, "false," intermittent or doubtful, each falling into a clearly defined group. Attention is drawn to those rare cases of traumatic pulsating exophthalmos where post-mortem examination reveals no obvious cause, and to the contrary group in which, though there is rupture of the carotid artery into the cavernous sinus, there is no pulsating

exophthalmos. Especially valuable is the section dealing with the treatment of these conditions; the stress laid on ligature of the superior ophthalmic vein has received much support by publications since 1920.

In the innumerable bibliographies the names of English authorities and journals are too frequently misspelt.

Die Differentialdiagnose der Wichtigen Augenerkrankungen und Augenverletzungen. By VICTOR HANKE. Pp. 104. Vienna and Berlin: Julius Springer. 1930. R.M. 4.00.

Hanke's book is one of a series of monographs on subjects of interest to general practitioners. The author of a book on the differential diagnosis of the more important eye conditions, is therefore under the disadvantage of speaking on highly technical subjects to a relatively uninitiated audience, and it must be allowed that he has creditably performed a difficult and thankless task. The appendix on the prescribing of glasses is particularly well done.

Some of the information in this little book is rather out of the ordinary. It is of interest to learn that sausage poisoning is a cause of absolute rigidity of the pupil, but it is bewildering to be told of 12 possible causes of a spot on the lids; the reviewer found is quite a task to remember only 11.

CORRESPONDENCE

We have received the following communication from the Honorary Secretary of the Midland Ophthalmological Society.

At the Annual Meeting of the Midland Ophthalmological Society held at Birmingham on October 7 the following resolution was carried unanimously: "The Members of the Midland Ophthalmological Society most emphatically repudiate the suggestion made in a paper published in the September number of *The British Journal of Ophthalmology* that 'It is impossible for a busy British oculist to spend so much of his time in quest of a hole.' They are prepared before performing a Gonin operation to spend as much time as is necessary to find the hole."

We would remind our readers that *The British Journal of Ophthalmology*, in common, we believe, with most other journals, does not accept responsibility for the opinions expressed by authors of original communications.

We have no doubt ourselves that British surgeons are always ready to devote as much time to any case as the interests of the patient demand.

EDITORS.

OBITUARY

Walter Edmunds, M.Ch.Camb., F.R.C.S.Eng.

WALTER EDMUNDS, who died on September 23, in his eightieth year, joined the Ophthalmological Society of the United Kingdom at its foundation, and was an active member during the first 10 or 12 years of its existence. His interest in ophthalmology was almost entirely on the pathological side, nearly all his contributions to the Transactions of the Society dealing with post-mortem findings in diseases in which involvement of the optic nerves and retinae occurred. He was associated in some of this work with W. A. Brailey (at that time Curator of the Museum of the Royal London Ophthalmic Hospital) and Nettleship. His last contribution to the Transactions was a valuable paper on " Experimental Exophthalmos and Enopththalmos." This was a record of work carried on through a series of years at the Brown Institute, where he devoted a great deal of time to experimental investigation. His most important work was on the thyroid and parathyroid glands; and in 1901 he gave the Erasmus Wilson Lectures at the Royal College of Surgeons on the " Pathology and Diseases of the Thyroid Gland."

Edmunds was a cultured man with wide and varied interests, photography and colour-photography being among his hobbies. He was one of the first to attempt photography of the *fundus oculi,* but the results were not sufficiently satisfactory to induce him to pursue the attempt.

It does not seem apposite to refer to his work in general surgery in this Journal.

Arthur Longley Whitehead

We are indebted to Mr. Harry Lee for the following notice: ARTHUR LONGLEY WHITEHEAD was educated at the Leeds Medical School and spent his whole life in Leeds. He graduated at London University in 1893 and was honoured by the Royal College of Surgeons electing him as a Fellow in 1924. He was appointed on to the Infirmary Staff in 1899 as Assistant-Surgeon to the Ophthalmic and Aural Department and in the same year was appointed to the full staff. In 1912 the two departments were separated and Whitehead and Secker Walker chose to carry on ophthalmic work only. He was Lecturer in Ophthalmology from 1912—1920. He was President of the Ophthalmic Section of the

Royal Society of Medicine 1922—1924; he had also been President of the North of England Ophthalmological Society and the West Riding Medico-Chirurgical Society. I had the good fortune to work with him for 11 years, and during that period found him at all times a most charming and firm friend. His capacity for work was astonishing and his methods of doing it were at all times of the greatest excellence. His operative work was outstanding both in technique and execution, and it was a great privilege to be able to see him at work, and to learn so much from him. Ophthalmology loses a brilliant servant in him. His reputation here and in the North of England was of the very highest order. It only remains to add that during his illness, which was a long and trying one, he showed that fortitude and patience which one would have expected from a man so exact and brilliant at his work.

NOTES

Deaths. WE regret to record the death on October 11, 1930, of Harry George Critchley, M.D., D.P.H., of Croydon, and of 145, Harley Street, W.1

As we go to press we learn with much regret of the death of Professor Ernst Fuchs, of Vienna.

* * * *

Honour. Mr. LESLIE PATON was elected Hon. Member of the Sociedad Oftalmológica Hispano-Americana on the occasion of the Society's XVth Congress held at Santiago de Galicia in September.

* * * *

Royal London Ophthalmic Hospital. Annual Dinner. THE Annual Dinner of past and present Students of the Royal London Ophthalmic Hospital will be held at the Langham Hotel on Thursday, February 12, 1931.

FUTURE ARRANGEMENTS

1930

December 2.—Midland Ophthalmological Society, at Birmingham.
December 5.—North of England Ophthalmological Society, at Leeds.

December 12.—Section of Ophthalmology, Royal Society of Medicine (Clinical Meeting), at the Central London Ophthalmic Hospital.

1931

January 9.—Section of Ophthalmology, Royal Society of Medicine.
January 16.—North of England Ophthalmological Society, address by Mr. H. M. Traquair at the Royal Infirmary, Manchester, at 4 o'clock. Subject: "The Principles of Perimetry."
January 19.—North of England Ophthalmological Society, address by Mr. H. M. Traquair at the University, Sheffield, at 4 o'clock. Subject: "Perimetry in the Study of Glaucoma."
January 20.—North of England Ophthalmological Society, address by Mr. H. M. Traquair at the General Infirmary, Leeds, at 4 o'clock. Subject: "The Value of Perimetry in the Localisation of certain Cerebral Lesions."
February 6.—North of England Ophthalmological Society, at Newcastle-on-Tyne.
February 6.—Midland Ophthalmological Society, at Leicester.
February 13.—Section of Ophthalmology, Royal Society of Medicine.
March 6.—North of England Ophthalmological Society, at Liverpool.
March 13.—Section of Ophthalmology, Royal Society of Medicine. (Clinical Meeting).
March 20.—North of England Ophthalmological Society, at Sheffield.
March 31.—Midland Ophthalmological Society, at Birmingham.
June 5.—Midland Ophthalmological Society, at Cheltenham.
June 12.—Section of Ophthalmology, Royal Society of Medicine. (Annual Meeting).
October 6.—Midland Ophthalmological Society, at Birmingham.
December 1.—Midland Ophthalmological Society, at Birmingham.

CONTEMPORARY OPHTHALMIC LITERATURE

American Journal of Ophthalmology. *September, 1930.*

LLOYD. Tuberculosis of the eye.
SUKER and CUSHMAN. A clinical study of sixteen cases of ocular tuberculosis.
JOHNS. Bilateral coloboma of the optic disc and choroid, with coloboma of the right iris.
POWELL. Herpes zoster ophthalmicus.
SCHENCK. Ocular myiasis,
ODENEAL. Transient hyperopia in diabetes.
LEWIS. Presbyopia, the bugbear.

October, 1930.

HAMBURGER. Theoretical and practical notes on glaucoma.
BARKAN, OTTO and BARKAN, HANS. Central and paracentral homonymous hemianopic scotomas.
FERREE, RAND and MONROE. Studies in perimetry: 4, Preliminary work on a diagnostic scale for the form field with a 0·17 degree stimulus.
VON DER HEYDT and GRADLE. Concerning contact glasses.
PETER. Tendon transplantation for paralysis of the superior rectus.
BULSON. Surgery of the closed pupil.
KEILTY. The bacterial flora of the normal conjunctiva with comparative nasal culture study.
MATHEWSON. Primary tumours of the optic nerve.
SWAB. Rat bite of eyelids resulting in rat-bite fever.
GRESSER. Condylomata at the inner canthi.
MORTON. Historic memorabilia regarding the visual field and perimetry.
REDWAY. Color photography for improved teaching of ophthalmology.

Archives of Ophthalmology. *September, 1930.*

PILLAT and YANG. The blood picture in keratomalacia in adults.
DUNNING. Oral infections and their relation to diseases of the eye from the point of view of the oral surgeon.
KENDALL and GIFFORD. Trachoma and avitaminosis.
HADEN. Some observations in regard to glaucoma simplex.
LEECH. Persistent posterior fibrovascular sheath of the lens caused by fetal iritis.
SPRATT. Trephining for buphthalmos: Report of a case observed for seventeen years.
LEBENSOHN. Car-sickness.
TÖRÖK and REDWAY. Three cases of keratoconus: Final report.
FRIEDENWALD. The permeability of the lens capsule to water, dextrose and other sugars.
BENNETT and PATTON. Oculogyric crises in postencephalitic states.
COHEN. Unrecognised retinoblastoma and pseudoretinoblastoma: Report of cases.

Annales d'Oculistique. *September, 1930.*

PÉRETZ. New study of the pre-operative complications of cataract in Egypt.
VEJDOVSKY. Tuberculous interstitial keratitis.
JUNES. Vertical keratotomy with scissors in extraction of senile cataract.
LAGRANGE. Minor degrees of night blindness.
GOMEZ-MARQUEZ. A new operation for pterygium

Archives d'Ophtalmologie. *October, 1930.*

WEEKERS and HUBIN. The stereoscopic acuity of one-eyed people from the point of view of their aptitude as motor drivers.
VEIL and FAVORY. Hereditary and familial cataract.
TRUC and DEJEAN. Ciliary wound and hernia from injury with glass. Recovery and complete conservation of eye.
ROCHE. The infectivity of trachoma.
PAGALIN. Does acute trachoma exist?
PUSCARIU. Iconography of orbito-ocular diseases from models.

Archiv für Ophthalmologie. *September, 1930.*

POOS. Development of the bulb under the influence of an increased muscular strain.
REHSTEINER. The first anatomical examination of a case of Leber's sex-linked hereditary optic atrophy.

SCHÖNENBERGER. Sympathetic ophthalmitis following Elliot's trephining operation, with histological findings.
POOS. On the effect of tuberculin on the normal eye.
SALLMANN. On the clinical meaning of some slit-lamp findings in the lens and cornea.
DREYFUSS. Symmetrical central fatty degeneration of the cornea in a dog.
OHM. On our knowledge of nystagmus.
LUTZ. On some further cases of bi-nasal hemianopsia.
BLATT. Disturbance of accommodation after cyclitis.
BEHR. The share of the two antagonists in the movements of the pupil in certain reactions.
DENIG. Iris fistula in glaucoma.
BENJAMINS and HUIZINGA. On the results on the tear passages of the operative treatment of maxillary sinusitis.

Klinische Monatsblätter für Augenheilkunde. *September, 1930.*

V. SZILY. In memoriam—Theodor Axenfeld.
VOGT. Injury to the eye by ray energy.
JUSEFOWA, CZERNY and HEINISMANN. Notice on the clinical and X-ray treatment of tumours of the pituitary.
CHURGINA. Crossed reaction in the primary effect and in reinfection in experimental tuberculosis of the rabbit's cornea.
V. PLANTA. Notes on the clinical aspect and histo-pathology of sclero-perikeratitis.
STASTNÍK. A new method of treatment of trachoma.
FILATOW and KALFA. On the question of the pathological anatomy and the treatment of Fuchs' epithelial dystrophy.
KOGAN. A case of fascicular keratitis resembling ulcus serpens.
SCHALL New treatment of filamentary keratitis.
DERKAČ. Transplantation of skin (Denig) in pannus trachomatosus.
KARBOWSKI. Critical observations on so-called Denig's operation.
SALLMANN. A simple retention apparatus for the radium carrier in treatment of the eye.
MERSIN. Trephining the cornea as a method of operative approach to the iris.
KNAPP. Notes on Dr. Friede's article "On the possibility of operative employment of a lid shield in the albinotic eye."
REICHERT. On the technique of the diascleral magnet operation.

Zeitschrift für Augenheilkunde. *September, 1930.*

SALZMANN. Iridectomy and injury to the lens and their prevention by iridectomia ab externo.
LANDEGGER. On our knowledge of familial amaurotic idiocy, of the Spielmeyer-Stock type.
GARDILCIE. On a new form of treatment of trachoma and of other superficial infective corneo-conjunctival affections.
MUSIAL. A case of glioma of the optic nerve.
REITSCH. "Dystopic apparent squint," and squint in art.

October, 1930.

BIRCH-HIRSCHFELD. The genesis of traumatic exophthalmos.
BLAIKNER. The operation of iridencleisis.
STEVENS. On the cause and connection of retinitis and retinal detachment with familial renal disease.
FRIEDE. On peripheral neurectomy in blepharospasm.
MARKUS. Practical successes with cylinder skiascopy.

Annali di Ottalmologia e Clinica Oculistica.

May-June, 1930.

OVIO. Examination of the light sense *(continuation and end)*.
PANICO. Penetration of lashes into the anterior and posterior chambers.
DEL DUCA. Liver treatment in ocular lesions in pernicious anaemia and similar conditions.
SANTORI. Primary adeno-carcinoma of the lacrimal gland.
MARNIOSCI. Variation in the retinal image and in the visual acuity in connection with the position of the correcting lenses in ametropia.
LODDONI. On the course of the nerve fibres in the optic nerve and the retina.
SCOTTI. On functional changes in the iris and ciliary body from contusions of the globe.

July, 1930.

TIERI. Retro-bulbar tumours.
BALACCO. On endothelial sarcoma of the choroid.
MARINOSCI. Investigation of conjunctival xerosis.
LODDONI. On an anomalous case of ocular pemphigus.
SCOTTI. On transillumination of the eye.

August-September, 1930.

HERTEL. Examination of the light sense with a spherical adaptometer to obtain unification *(continuation and end)*.
MARGOTTA. Micrometry of the fundus.
SCOTTI. On variations of the intra-ocular tension in anterior uveitis.
SANTANASTASO. On fatty degeneration of the human eye.
FRATICELLI. X-ray in hypophyseal tumours and the chiasmal syndrome. Technique and results.
MORETTI. Epithelial xerosis with small spots on the palpebral conjunctiva.
LEWIS. Guiseppe Cirincione—head of Italian ophthalmology.

Archivio di Ottalmologia. *June, 1930.*

FEDERICI. Urotropine in the cure of sympathetic ophthalmitis.
——— Rare traumatic affections of the retina associated with the commotio retinae of Berlin.

July, 1930.

SGROSSO. Comparative researches into refractometry and the other clinical examinations in refraction.
CAVARA and FEDERICI. On the late results of anterior sclerectomy (Lagrange and Elliot) in simple chronic glaucoma in a very advanced stage.

Bollettino d'Oculistica. *August, 1930.*

ROSSI. Medical and surgical treatment of glaucoma.
OBLATH. The correction of all errors of refraction with curved contact glasses.
SCALINCI. Concerning the pathogenesis of chronic toxic amblyopia.
TESSIER. Intra-ocular tension and adrenalin.

September, 1930.

CAVARA and BENCINI. On Gonin's operation for detached retina.
GENNARO. Contribution to the histopathology of spring catarrh.
FEDERICI. On the question of the activity of cocaine.
SANTORI. Retrobulbar neuritis.

Lettura Oftalmologica. *August, 1930.*

TESSIER. The influence of prolonged instillations of atropine and pilocarpine in rabbits from birth.
TIERI. Iriscopy and its clinical importance in some particular aspects of neuro-syphilis.
TESSIER. The intra-ocular tension in glaucoma patients after prolonged forward flexion of the head.
MARINOSCI. Absolute glaucoma with deep anterior chamber.

September, 1930.

MARINOSCI. On corneal sensibility in normal and pathological states.
PANDOLFI. Contribution to the study of the connection between glaucoma and myopia.

October, 1930.

ANTONIBON. A case of bilateral X-ray cataract.
MARINOSCI. New contribution to the study of degenerative processes of the cornea in trachomatous eyes
KOCH. Clinical and therapeutic considerations on trachoma.

Revista Oto-Neuro-Oftalmologica. *July-August, 1930.*

DI MARZIO and FUMAROLA. Disturbances of associated movements of the eyes.
CHALLIOL. Symptomatology of intrapontine tumours.

Archives de Oftalmologia. *September, 1930.*

MARQUEZ. Concerning stereoscopic vision of anaglyphs.
MENDOZA. The surgery of the sclerotic.
CASTRESANA. My model forceps for extraction of cataract *in toto*.
BUFILL. Ocular paralyses after spinal anaesthesia.
MARIN AMAT. Primary tubercle of the conjunctiva following lupus of the nose.

October, 1930.

COSTI. Glaucoma with pre-menstrual aggravation
MARIN AMAT. On a new case of "Marcus Gunn's phenomenon."

Revista Cubana de Oftalmologia y Oto-Rino-Laryngologia.

YANES. Three new cases of cranio-facial dysostosis of Crouzon.
AMSLER. The technique of puncture in retinal tears and Gonin's operation.
SOURDILLE. Note on the pathogenesis and treatment of detached retina.

Revista Oto-Neuro-Oftalmologica y de Cirugia Neurologica.

October, 1930.

COPPEZ. On the tension of the central artery of the retina and its diagnostic value.

November, 1930.

VAN LINT. Neuroparalytic keratitis in an infant of eighteen months.

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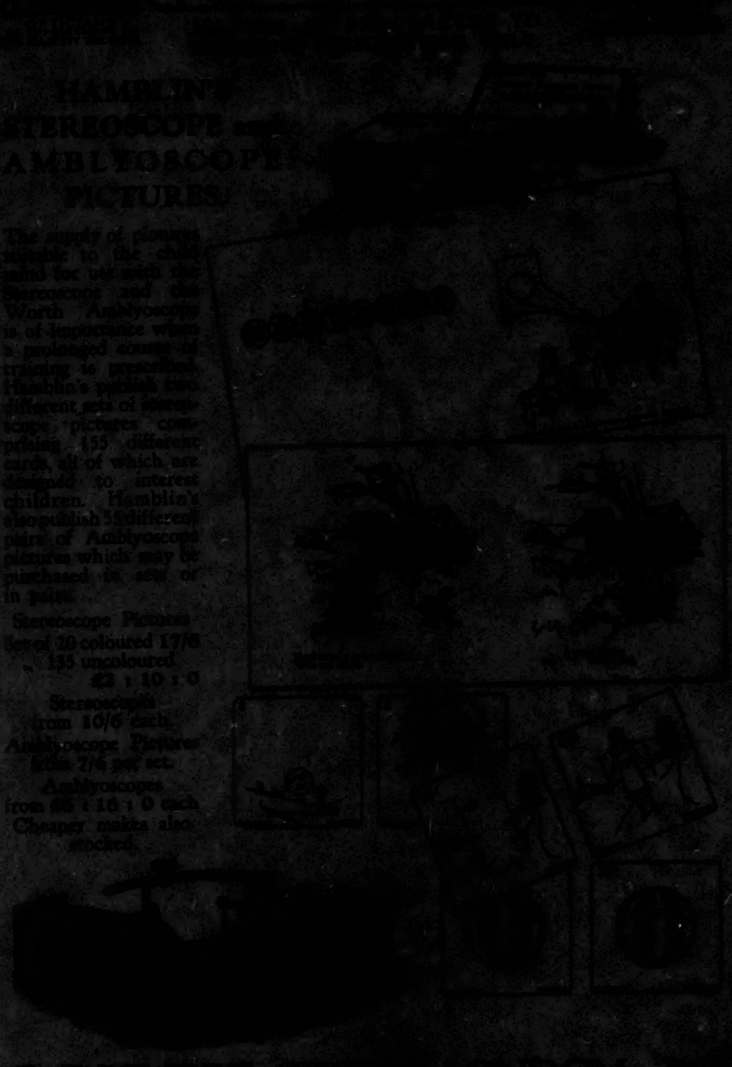

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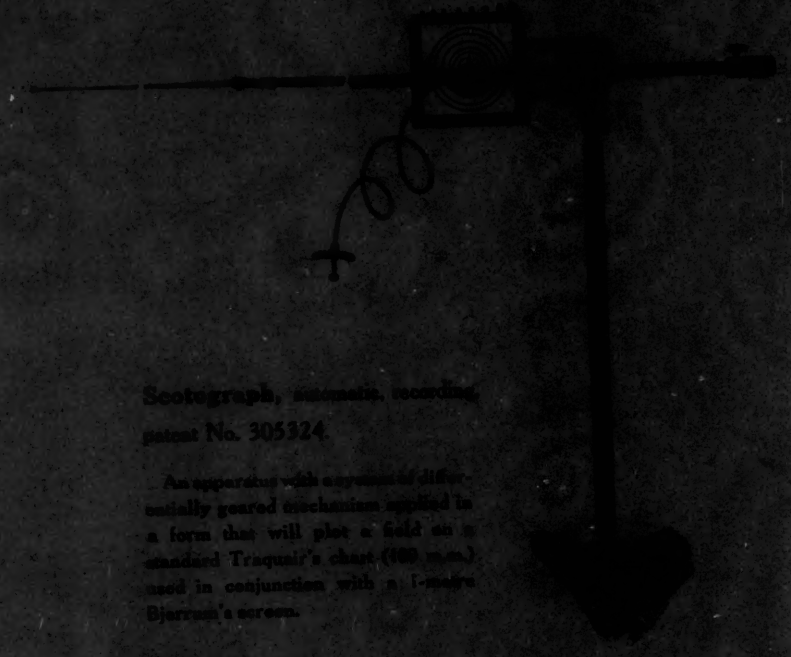

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